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**VOLUME 8, No. 2** **FEBRUARY 1956**

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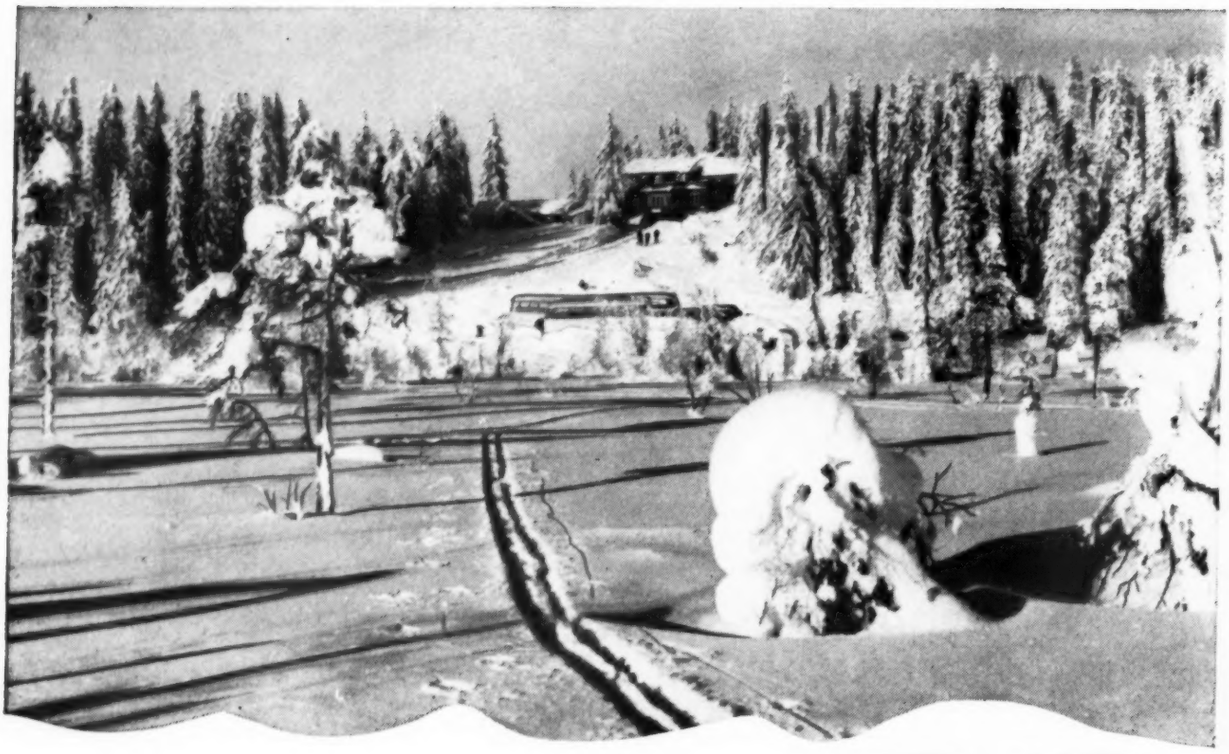

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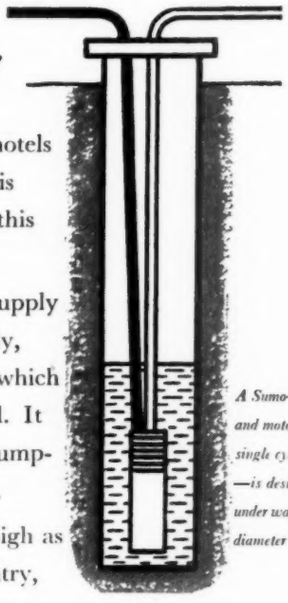

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# WORLD CROPS

Vol. 8, No. 2

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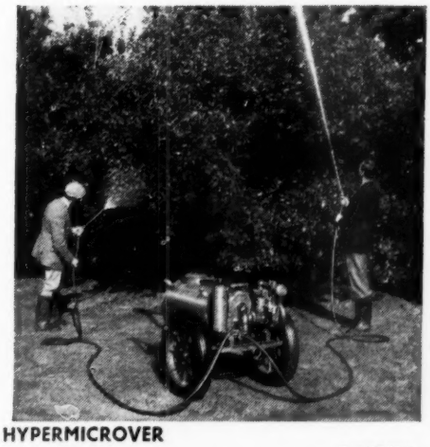

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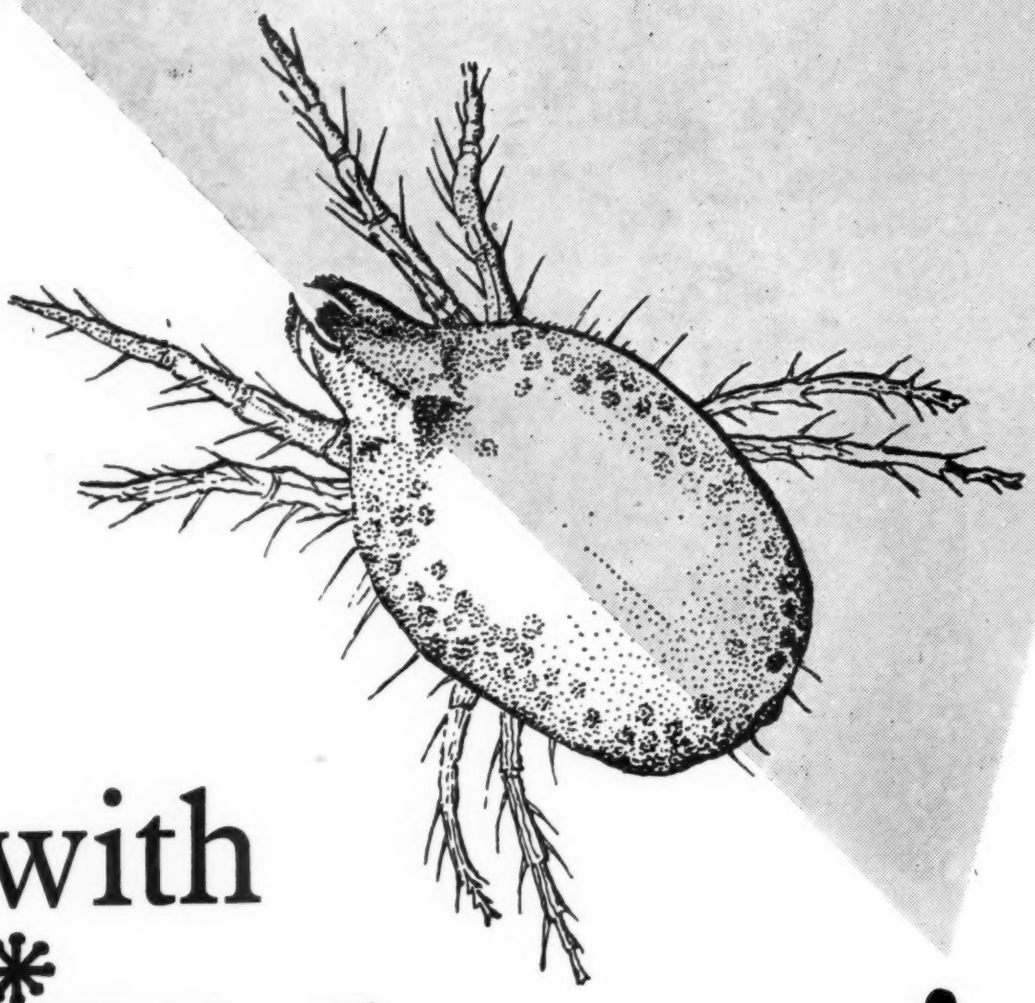

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# Editorial Comment

## FAO election

BRITAIN'S failure to secure renomination to the Council of the Food and Agriculture Organisation at the election at the end of November is attributed in Rome largely to Britain's advocation of economy by FAO. There is a feeling, particularly among the underdeveloped countries, against Britain's support for efforts that have been made by the U.S.A. and other governments to keep down FAO's expenditure. Many members of the organisation are said to resent supposed English-speaking domination in the affairs of the organisation. A British Treasury management-survey team that has been studying possible economies in the running of FAO is alleged, in Rome, to have carried out its work in such a way as to favour the retention of jobs by British employees of the organisation.

Although the evidence for such an allegation is extremely doubtful, it is clear that there exists a strong feeling against any economy in the work of FAO. The conference adopted the budget figures of $6,600,000 for FAO's work in 1956, and $6,800,000 in 1957. Dr. Philip Cardon, the Director-General of FAO, originally disputed these figures and urged a budget of $7 million for each of the next two years. On the other hand, the American, British and other governments urged a figure of $6,400,000 as the maximum to be spent. The resulting compromise proposal passed through the committee by the narrow margin of 24 votes to 23.

## Fertilisers and animal health

THE intensive cultivation of pasture herbage with fertilisers is sometimes blamed for serious disorders in the health of grazing animals. In some parts of Europe grass tetany is seriously incident and it would seem to occur when animals start grazing on new and lush pastures. Hypomagnesaemia is said to be on the increase in Britain and veterinary opinion has sometimes attributed this to a lowering of magnesium content in herbage caused through the raising of other mineral nutrients. However, two recent articles, both of considerable status, have disposed of these fears. A German paper (Alten and Doehring) published by the International Potash Institute, Berne, has shown (*a*) that cows can tolerate huge excesses of potash in their diet without ill effects and certainly without developing tetany symptoms, and (*b*) that grass tetany never affects all animals in a grazing herd, but only individual animals which have a highly-strung, nervous disposition. If some mineral non-balance in the fertiliser-fed pasture was the cause of tetany (and high potassium content has been indicated), outbreaks would be much more general. In fact, tetany seems to be due to the inbred nervous disability of high-milk-yielding cows—it is ' sparked off ' by the sudden change in environment presented by the new pasture.

On hypomagnesaemia, an article by Ruth Allcroft (*Agricultural Review*, 1955, **1**, No. 7, p. 47), of the Weybridge Veterinary Laboratory (Ministry of Agriculture, Fisheries and Food), points out that this disorder is not due to a deficiency of magnesium—it occurs too suddenly to be explained by depletion of the animal's magnesium reserves. The fact that additional magnesium in the diet is often the best remedial treatment cannot be taken as proof that magnesium deficiency in the pasture or fodder is the primary cause. Large-scale experiments have not correlated this disorder's incidence with magnesium contents of grazing swards. Its occurrence may be associated with the spring or autumn flush of grass growth, whether or not this has been increased by the use of fertilisers.

## Australian grasshopper plague

ALTHOUGH aerial defences were prepared, these were pierced by the teeming millions of grasshoppers that swarmed across the New South Wales border into Victoria in mid-December. It was the worst plague that the State had known. At the time of going to press the grasshoppers were threatening millions of pounds' worth of crops in the rich Murray Valley, and Mr. Henry Bolte, the Victorian Premier, stated that they had already cost the Victorian Government £A200,000.

Local reports said that the skies were black for 50 miles between Tocumwal and Yarrawonga despite aerial spraying of poison. There were fears that the countryside would appear ' like the Sahara Desert ' after the grasshoppers had passed.

The Australian Prime Minister, Mr. R. G. Menzies, has made additional aircraft available to spray hundreds of square miles in an attempt to wipe out the pests.

## U.S. policy

A NEW six-point programme for U.S. agricultural policy, approved by President Eisenhower after his illness, was announced by the U.S.D.A. Secretary, Mr. Ezra Benson, towards the end of 1955. Like most political statements made against the setting of a close party struggle, it seemed broadly verbal rather than precisely factual. The first point may well have been intended for home consumption—the disposal of surpluses and the expansion of exports was to be vigorously

stepped up! The dual phrasing of this statement is a little alarming. It is one thing for the U.S.A. to talk about expanding agricultural exports; many countries would be glad to co-operate if they could earn more dollars with their own exports. But it is another to talk about ' disposal of surpluses '! This can mean dumping, and dumping surpluses well under production costs is still the fuse of world economic depression, whatever new verbal dressing is given to it.

The second point in the new programme does not minimise alarm—' a vigorous purchase programme to remove gluts '. If this means what it says, stocks of surplus agricultural produce in the U.S.A. will tend to increase, and this must intensify the pressure for ' disposal '. Western Europe is an experienced observer of American political gambits during pre-Presidential-election periods. Europe is older and far less ingenuous. It seems highly improbable that any country striving to maintain a balanced agricultural–industrial policy would allow the cheap-food temptation of a U.S. ' disposal ' offer to tear the heart out of its farming community. There is no illusion of world peace as there was in the late 'twenties and early 'thirties. The strategic importance of a home agriculture is too vividly realisable, and no government with a vestige of statesmanship could dare to seek the transient bubble of cheap food at the price of a broken agriculture. Farm voting power counts on both sides of the Atlantic.

It is unlikely that U.S. political opinion is blind to this general situation. Unless the promise of a 'stepped-up surplus disposal ' effort is purely advance pre-election propaganda, it could far more sensibly imply that the U.S. is prepared to expand offers of food surpluses to highly populated, but backward, countries. There is still plenty of under-nutrition in the world. It is still ironic that gold and currency distinctions can lock up food surpluses until they reach embarrassing proportions. In the long run Washington must see far more world-political kudos in disposing of surpluses to populations that badly need more food than in running the risk of indictment for pulling the trigger of a repeat performance of the depression of the 1930s.

## Chinese agriculture

AN interesting editorial on Chinese agriculture appeared recently in the *Manchester Guardian*. It says that the Chinese Government is not optimistic about the rapid increase in agricultural production, although in the last three months (October–December) the number of co-operative farms has almost doubled. There are now a million and a quarter. The pronouncements last summer in Peking about the speeding up of collectivation are thus being followed by radical action. As no foreign journalists are allowed to travel freely about the Chinese countryside, it is not easy to form an opinion about what is an obviously interesting social experiment, but a guide can be obtained from the Chinese press. A recent article in the *People's Daily* says that in many areas the poorer farmers are being prevented from joining the co-operatives, and it calls this a ' relatively serious problem '. From the time of the land reform the Communists have usually favoured the so-called middle peasants. The richer farmers have been molested, but the poorest have been neglected, at least in comparison with those of the middle rank. From this information it looks as if there is a struggle by the middle peasants to maintain their relatively privileged position. The *People's Daily* says that in many regions the Communist cadres have allowed themselves to be used by the middle peasants; it says that those who discriminate against the poorer farmers should be expelled from the Communist Party.

The Chairman of the National Construction Committee wrote in November that it would take over 20 years for Chinese agriculture to reach the same technical level as Russia's. A programme for mass rural education has been announced by the Government, who estimate that about three-quarters of the younger farmers are illiterate. The details of the programme appear similar to those of the pioneer in rural education, Dr. J. Yen, who flourished under the Kuomintang.

## Myxomatosis in Australia

WITHIN the next five to 10 years myxomatosis will be a relatively spent force as a method of destroying rabbits in Australia. It is estimated that unless rabbits are eliminated by 1960 50% will have an inherited resistance to the virus; consequently it can have no effect on them and they will thrive just as happily as they ever did.

From the inception of the disease scientists warned that the virus might lose its power over rabbits; they now definitely know that this is so.

To say that this is a tragic forecast is under-estimating the position considerably. The damage caused to soil and crops is incalculable now, but what it will be by 1970 or even before is quite beyond speculation. Every effort must be made to annihilate the species entirely. An 80% result is not good enough. The next time the virus is let loose it will not kill that many; at least 10% will have built up an immunity. And the next time it will be more, until the obvious result of total inherited resistance.

The solution lies with the farmer. Scientists have little prospect of developing or isolating an equivalent to myxomatosis. The farmer must destroy rabbits now, and when his property is clear fence it off and make sure it stays clear. It is considered that the virus is at its peak as a killer, so now is the time to step in and make sure it does the job properly.

## Beer facts

IN the little book entitled ' Beer and Brewing in America ', Morris Weeks, Jr., writing for the United States Brewers Foundation makes the following observation: ' The expression " Mind your p's and q's " probably originated in an English tavern-keeping practice; that of recording ale customers' drinks—by pints and quarts—on account sheets '.

The subject of beer and ale is also a quite appropriate topic for WORLD CROPS, for maize has one of its most important roles in the brewing of lager and its related beverages. However, most beer drinkers today have somewhat fussy tastes; to meet this discriminating demand the brewers have to mind the ' p's and q's ' of beer, using the choicest products of agriculture and processing them according to rigid and exact standards.

The Brewers Foundation go on to say that when prehistoric man began to farm, the materials of brewing were ready to his hand. Presumably, too, when man became smart enough to till the soil he was smart enough to think that perhaps his diet could stand some improvement.

Actual proof exists of brewing at least 2,600 years ago—a Mesopotamian seal or drawing, baked in pottery and showing two workers at a brewing vat. In 1502 Christopher Columbus found the natives of Central America brewing ' a sort of wine made of maize, resembling English beer '.

The three main ingredients in today's beer are malt (barley germinated in water, and dried), cereal products (maize or rice) and hops.

Some interesting facts have come to light in this booklet; the Brewers Foundation points out that the word ' beer ' comes from the Latin verb *bibere*, to drink. ' In the 8th century the noun, in Old High German, took the form of *peor* or *bior*. Today the Germans call it *bier*, the French *bière;* even the Japanese have their version, *biru*. In Spain and Latin America, however, a different Latin root led to the modern word for beer, *cerveza*. This began as *cerevisia*, which some philologists say combines the Latin *Ceres*, goddess of grain, and *vis*, for vigour '.

By any name it is one of our favourites among all products made with the help of maize.

## Irradiation postscript

OUR recent comments about atomic rays and seed genetics (see WORLD CROPS, 1956, **8**, 1) has been followed swiftly by the U.S. announcement of an outstanding piece of seed-irradiation success. In the new American publication, ' Atoms for Peace Digest ' (1955, 1, 13, 6), experiments with the peanut crop that began as far back as 1949 are described. Peanut seeds (60,000), which had been exposed to radiation at the Oak Ridge atomic energy plant, were planted; subsequent growth showed that many mutations and species-changes had been induced, *e.g.* plants that had upright branches, prostrate branches, large or short bush structures, thick or thin stems, or miniature root systems. The following year 500,000 seeds from selected plants in the 1949-irradiated batch were sown, and during this second experimental year heavy-cropping plants and leaf-spot-resistant plants were picked out. This process of selection from the initially random effects of irradiation-induced mutation was continued for three years. Three new and improved varieties have emerged. One that crops one-third more heavily than any previously known variety; one that is completely resistant to leaf-spot; and one whose shape and size of pod are ideally suited to mechanical harvesting. Nor is this story at its end. Further research based upon normal plant-breeding methods is expected to produce a single new variety in which these three major and new characteristics are combined.

## British research

WHEN Lord Rothschild recently addressed the Farmers' Club on British agricultural research the outstanding impression was his own enthusiasm for research. It is quite clear that, as chairman of the Agricultural Research Council (A.R.C.), he will firmly resist economic contractions or the even more insidious effects of official apathy. Too often in the past the central control of our State-organised scientific bodies has displayed too much dead hand technique and far too little live wire.

However, Lord Rothschild's most able account of the present scope and *modus operandi* of the A.R.C. revealed deficiencies. The energetic discussion that followed his paper revealed the largest deficiency—inadequate liaison between research and farming. This is a two-way imperfection. It was clear from some farmers' comments that the function of *genuine* research is misunderstood, that research is looked upon as a short-term, quick-return process of simple trial and error. Its much more fundamental nature, with applications for tomorrow's farming rather than today's, seems little appreciated. Lord Rothschild himself thought that all our research centres should have a liaison officer attached to them, a senior officer whose main task was to bring research and the farming community closer together. All those who remember the pre-N.A.A.S. period, when a number of research centres also operated regional advisory services, will welcome this view. The virtually complete separation of research and advisory work has not been a forward step. Yet this separation has largely been a matter of administration—most advisory officers would have preferred closer contacts with their research colleagues.

Another deficiency revealed was the absence of agricultural economics research from any list of A.R.C. responsibilities. This major subject seems to be some-

thing of a waif or stray, which no doubt accounts for its obvious signs of malnutrition and stunted growth. It is a subject that has been excluded from the A.R.C.'s range of interests and, to put the matter bluntly, nobody seems to know why. For getting research put into practice, economic surveys of farming are invaluable, for they spotlight hidden necessities and unrecognised weaknesses. Here is a branch of research that has leapt into importance in recent times, but which has shared all too meagrely in the general expansion of our agricultural research plans and facilities.

## Fifty-fifty

IT was reported recently in the daily press that special committees have been set up by the leading U.S. shipping organisations with the object of helping to promote the sale of American farm products overseas. A Farm Export Promotion Committee has been set up by the American Merchant Marine Institute, and a similar organisation has been set up by the Pacific American Steamship Association, which represents shipping lines based on the west coast.

It seems that the aims of the new groups are to concern the foreign representatives of U.S. shipping lines with the problem of finding markets for agricultural products in the countries where they are stationed. They are expected to bring buyers and sellers together up to the point of actually closing deals.

It appears that this development represents an attempt by the shippers to heal a long-standing breach with the American farmers. The U.S. shipping industry is materially aided by the so-called ' fifty-fifty ' law, by which 50% of all Government-sponsored cargoes must be shipped abroad in American ships. This has been opposed by the farmers, as they contend that it impedes the maximum flow of agricultural surpluses overseas. But recently the Merchant Marine Institute obtained from the National Grange, one of the leading farmer organisations, an endorsement that the U.S. merchant marine is an indispensable link to foreign markets.

By means of meetings and promotional programmes the shippers hope to wean the farmers away from their opposition to the ' fifty-fifty ' law.

## Colonial research

THE Colonial Office's 1954–55 report on 'Colonial Research ' (H.M.S.O., Cmd. 9626, pp. 316, 9s.) is an impressive and sizable document. Many people may be led to suppose from both this and an over-hasty acceptance of the sums of expenditure that all is well with the scientific pathway to colonial development. During the year reported grants totalling £533,548 were made for 52 new research projects and 48 supplementary schemes. £8 million has been allocated for the period 1955–60, which suggests a future rate of annual research expenditure of £1,600,000, compared with £1,173,381 for the year 1954–55. However, almost half (£3,976,000) of the £8 million is composed of an *unspent* balance from the previous allocation! Two deductions must be drawn from this: the plain fact that the new grant of £8 million does not represent some fresh spirit of munificence, and the more suspicious possibility that when 1960 arrives a substantial proportion of the £8 million may also remain unspent.

None of this would perhaps matter much if the sums involved were adequate. Figures in millions always seem big, but they must be weighed in the scales of relativity. Even if some of our prewar and larger colonies have achieved Dominion status, the total area and population of the colonies are still very great. Generally, basic conditions are backward in any technological sense, and research needs, especially for applied research, are immense. Developing colonial resources, fostering better living conditions, dispersing poverty standards, these are responsibilities that must be fully undertaken if in the eyes of the rest of the world the charge of exploitation is to be dismissed. £8 million for five years of colonial research is a very small sum when judged against this background. Britain has spent more than five times this sum annually in the last two years on imports of animal feeding-stuffs, excluding coarse grains, and is devoting twice this sum each year to subsidising fertiliser purchases. It is half the amount of the trading profit of one of the large British store organisations and about the same size as the trading profit of Britain's largest film and cinema group. For those who would prefer a research-to-research comparison, it is only about 20–25% greater than the annual D.S.I.R. expenditure.

It can be said in defence that existent or planned colonial research projects do not require any greater financing, that the unspent balance of almost £4 million from previous allocations proves this. But all this means is that the sights for colonial research urgently need widening. There should be so much colonial research in hand or waiting for ' starter's orders ' that this five-year sum of £8 million should melt like an iceberg in the Gulf Stream.

In making these critical comments we would not wish to appear critical of the actual research work that is being done or of the way in which the limited funds are shared out. The 1954–55 report clearly shows that what is being spent brings good value in return; and about one-third is spent upon agricultural, animal health and forestry investigations. There is nothing wrong with the quality or balance of the present effort. What is wrong is that it is only a pilot-scale venture, an under-sized prototype of what Britain should be doing.

# The Work of the Sarawak Department of Agriculture

R. W. R. MILLER, B.A., DIP. AGRIC. SCI. (CANTAB.)
(*Director of Agriculture, Sarawak*)

*The Sarawak Department of Agriculture is making successful efforts to improve the standard of padi cultivation and to rehabilitate the rubber industry in that country. Progress, although positive, is difficult, for three-quarters of its 47,000 sq. miles is still under primary jungle and there are many complicating factors. Livestock and fisheries are among the subjects dealt with by the Director of Agriculture in this report.*

SARAWAK is still one of the lesser-known parts of the world and in order that the background to the Department's work can be appreciated it is necessary to include in this report some general information on the country and its rural industries. Besides being responsible for the usual work of a Department of Agriculture, the Sarawak Department is responsible for work on rubber, livestock husbandry and fisheries (both marine and freshwater); brief notes on these aspects of the country's rural industries are therefore also included.

## Topography

The total area of Sarawak is approximately 47,000 sq. miles and about three-quarters is still under primary jungle. It is estimated that 5,600 sq. miles of the flat deltaic and coastal regions consist of primary jungle on deep peat swamp at or near sea level; this land is unsuitable as it stands for agricultural purposes and it will probably be impracticable and uneconomic to reclaim much of it for wet padi cultivation; however, there are considerable areas of moderately productive wet padi land estimated at a total of not more than 2,000 sq. miles, mainly situated on the river banks in the deltas. The flat coastal areas pass abruptly into the steep hills and mountains that form much of the interior; flat land is occasionally found between the hills and mountains and the existence of some plateaux has been confirmed, but the total extent of flat land in the interior is comparatively small, and it is generally difficult of access from the coastal areas. Outcrops of igneous rocks do occur and where they are found there is often a marked local improvement in the quality of the soils in the area; unfortunately, the extent of the good soils in the interior is comparatively small and a large proportion of the soils must be regarded as poor.

Communications are generally still in a primitive state of development and depend largely on rivers and footpaths.

## Population

The 1947 census showed that the total population of about 546,500 is made up roughly as follows:

| | |
|---|---|
| Malays .. .. .. | 97,500 |
| Melanaus .. .. .. | 35,500 |
| Sea Dayaks or Ibans .. | 190,500 |
| Land Dayaks .. .. | 42,000 |
| Other indigenous races .. | 30,000 |
| Chinese .. .. .. | 145,000 |
| Balance (Europeans, Indians and other non-indigenous races) .. | 6,000 |

Malay is to some extent a lingua franca, but many of the races only speak and understand their own language.

To a considerable extent the Malays live in the coastal and deltaic areas and are mainly concerned with wet padi farming and fishing; the Melanaus also live in certain of the coastal areas, but are mainly concerned with sago-palm cultivation and fishing. A large proportion of the Sea Dayaks and Land Dayaks inhabit the hills of the hinterland, and their whole life and economy revolves round a system of hill padi farming, based on bush fallows. The Chinese used to be regarded as the country's traders and were largely confined to the towns, but of late years they have spread a great deal into the rural areas and now form some of the most progressive and prosperous farmers, particularly as far as rubber and pepper production is concerned.

## Rainfall

The average annual rainfall is about 160 in.; in the south-west there is a

*Terraced pepper garden at Department of Agriculture development centre, Semongok, First Division*

definite period of maximum rainfall during the months of November, December, January and February, and during that period rainstorms of exceptional intensity are usual, but in the north-east the maxima and the minima are not so pronounced and the distribution of rainfall is more uniform. The heavy storms sometimes cause disastrous floods, which may well be one of the main reasons for the limited development of agriculture in the past; unfortunately, the limited areas of good alluvial soil are all too often particularly subject to serious flooding. Heavy rainfall is often succeeded by short, hot, dry periods and vegetation on the thin, leached soils that are so common then, quickly gives the impression of a prolonged drought. Shade temperatures average 80° F. and daily minima below 70° F. or maxima above 90° F. are seldom recorded. Atmospheric humidity is generally high, but particularly in dry spells there is a marked drop in relative humidity during the early afternoon. Sunshine records have only recently been started, but it seems that the average for the country will be only five hours' bright sunshine daily, and perhaps less.

Owing to the dearth of previously recorded information about agricultural conditions in Sarawak, the Department of Agriculture has, since the end of the war, largely had to concentrate on preliminary surveys and investigations.

### Farming systems

The policy in the past has been to base development on the encouragement of the small native farmer, working a mixed system of farming, rather than on encouragement of large specialised plantations, worked by daily paid labour. Small farms are indeed the basis of the country's agriculture, but it is rare to find family farms or smallholdings in the usually accepted sense of the term, and methods of working and financing the small farms are complex and variable. Daily-paid local labour is employed by the owner of even small rubber and pepper gardens and various forms of share cropping are common. Frequently Dayak owners of small rubber gardens do not work the gardens themselves, but the highest Chinese bidder is allowed to do so. The owners of small rubber and pepper gardens are often indebted to local shopkeepers to such an extent that the shopkeepers have virtually become the owners and the original owner a paid workman on some system of share cropping. As far as subsistence padi farming is concerned (both on the hills and in the swamps), the individual generally does work to some extent independently, though there is some tendency for a community to farm together as such when it is obviously to their advantage to do so.

It is now generally agreed that if modern methods are to be widely adopted (as they must be if Sarawak's farmers are to survive economically) then some control over the individual will be necessary and that this control can be best exercised through the establishment of 'group farming' schemes. Some quite successful 'group farming' projects have been established and the majority of the farmers seem to welcome a measure of control. The prospects of such 'group farming' schemes being controlled by farmers' committees on their own are not now regarded as promising and it seems likely, as a result of experience, that trained and experienced paid community development leaders for all such schemes will be essential for success.

A limited number of development centres have been established throughout the country by the Department, and these centres are striking demonstrations of what can be achieved by stabilised intensive methods of farming instead of the extensive methods that are all too common. The centres are the focal points of the Department's work and living accommodation is available at some of them for visiting farmers and is being extended; it is hoped that eventually when the staff situation improves it will be possible to establish farm schools at the centres.

The overall staff situation in the Department is extremely difficult and acute shortage of experienced, trained men is seriously limiting its activities. This particularly applies to fully qualified agricultural officers, and there are now five vacancies in an authorised establishment of seven. The position with recruitment of men of suitable physique and general education for the most junior grades of the locally recruited field staff has improved recently, but it is still difficult to find suitable recruits with adequate background of general education for training for the intermediate grade of agricultural assistants. The Department has established its own Staff Training School near Kuching and is concentrating on the training of selected men as agricultural assistants. Scholarships for the training of Sarawak men as agricultural officers at recognised centres abroad are now also available, and increasing numbers of suitable candidates are beginning to come forward.

## Crops

### Padi

Rice is Sarawak's staple foodstuff, and padi is the main crop. From the technical point of view Sarawak could be self-supporting in rice, and when prices for the main export products are low the country does approach self-sufficiency in the commodity; when prices of export products are high interest in padi planting wanes and the country may become dependent on imports for as much as half of its rice requirements.

*Dry padi.*—Dry padi, cultivated on the hills under a system of bush fallow farming, accounts for much of the padi produced. When adequate bush fallows are maintained, the system is not an unsound way of using Sarawak's poor hill land for food production; when abused it leads to serious problems regarding the conservation of natural resources. No detailed statistics are available about the crop, but it is estimated that on the average about 500,000 acres of jungle and scrub are cleared each year for the purpose. Under favourable conditions surprisingly good yields of excellent quality padi are obtainable, but there are often poor crops, and even complete failures; pest damage is often severe. Over a period of years it is estimated that yields of hill padi over the whole country do not exceed 100 gantangs (gallons) per acre. The Department of Agriculture's work in connection with this crop is largely concerned with endeavours to preserve adequate bush fallows between successive crops and to introduce suitable methods of pest control to the farmers; zinc phosphide rat-poison baits and BHC-type insecticides are proving most effective, and the farmers are

[Lands and Survey Dept., Sarawak] [Crown copyright reserved]

buying increasing quantities of these pesticides. Some success has been obtained in experiments by the Department with the use of fertilisers on this crop; it may prove feasible to use fertilisers in places near to good river communications, but generally it is feared the practice may not prove practicable in Sarawak.

*Wet padi.*—Wet padi is cultivated mainly in the deltas and in the coastal areas. The methods used vary from true swamp cultivation to cultivation of extensive semi-wet padi on river-bank levees; stabilised, intensive wet padi cultivation on the basis of efficient water control is not common. Yields are generally low and probably do not average more than 200 gantangs per acre. The acreage of wet padi varies considerably from year to year, but the maximum planted each year is about 200,000 acres. There is considerable scope for intensification of production of wet padi, particularly on the basis of improved water control. A great deal can be done to conserve rain falling on the fields by simple methods of drainage control, and this matter receives a great deal of attention from the Department of Agriculture. The distribution of rainfall in Sarawak is such that some irrigation water is generally necessary for really intensive wet padi cultivation; some success has been obtained with small diesel-operated, centrifugal irrigation pumps, but a need for major water-control works is becoming apparent. The design and construction of such work presents unusual difficulties in Sarawak and is quite beyond the capacity of the Department of Agriculture (there is no drainage and irrigation department in Sarawak); with financial assistance from the U.K. Government a firm of consulting engineers has therefore been engaged to survey the most promising wet padi land and to make recommendations with regard to construction of water-control works.

Work on Sarawak's wet padi fields is exceptionally exhausting, owing to the climatic conditions. The use of animals to cultivate the padi fields is uncommon and there do seem to be sound reasons for this. There will be no point in developing large areas for wet padi cultivation if they are going to be beyond the capacity of Sarawak farmers to work. The use of modern machinery is an obvious way of meeting the difficulty, but, unfortunately, experiments by the Department of Agriculture have shown that conventional types of machinery cannot cope with the difficult conditions encountered on the type of swamp land that forms much of Sarawak's promising wet padi land. Considerable importance is therefore attached to experiments, based on cable traction, that are being conducted in Brunei on the recommendation of the Sarawak Director of Agriculture (the Sarawak Director of Agriculture is also Agricultural Adviser to the State of Brunei). The experiments have been entrusted to the same firm of consulting engineers that is conducting the wet - padi - land surveys.

## Rubber

Rubber is the chief tree crop and R.S.S. rubber is the most important agricultural export. The total area is estimated at 250,000 acres and exports in 1954 totalled 22,966 tons. Quality of the product is generally extremely poor. Most of the rubber is old seedling rubber in very poor condition and must be regarded as a wasting asset. Management of the trees is generally of a very low standard.

To provide a basis for improvement of quality, the Department of Agriculture possesses a small, modern processing factory near Kuching, which operates on latex collected from surrounding smallholders. The factory is quite popular with surrounding smallholders who supply the latex, because they get increased returns for less trouble than they would do if they made and marketed their own sheet. Unfortunately, there is not enough rubber within easy reach of the factory to make it possible to work the factory up to full capacity, and this disadvantage would apply to the majority of possible sites for additional factories throughout Sarawak.

As a further step towards improvement of the rubber industry, the Government recently purchased the former Japanese-owned Samarahan Estate near Kuching. About 2,000 acres are in tapping and the estate is managed for the Government by Sarawak Rubber Estates Ltd., in close co-operation with the Department of Agriculture. The estate made a useful profit in 1954. Considerable rebuilding and replanting is being undertaken. A training school for training the Department's staff in modern rubber-production techniques has been established on the estate, and large nurseries for supply of high-yielding planting material to smallholders will soon be in production. The tappers are paid on a profit-sharing basis and increasing social services are being made available to them; much of the labour is seasonal and the estate is becoming a community-development project of outstanding interest.

Owing to the increasing menace of synthetic rubber, it is becoming most urgently necessary to get increased acreages under high-yielding rubber in Sarawak, and increasing interest is being shown in the matter by rubber gardeners. Recently the Government authorised major expenditure on replanting subsidies and it is hoped that a comprehensive scheme will soon be in operation.

## Sago

Sago is an important tree crop in certain of the swampy, coastal areas, and it is estimated that about 75,000 acres are under productive sago. Yields are not high and, as the methods of extracting the flour are generally primitive, the quality of the product is poor. Exports of refined sago flour in 1954 totalled 12,694 tons.

Technical investigations on processing and marketing of sago flour are being carried out by the Department of Agriculture, in co-operation with the Imperial Institute and the trade. There seems no doubt that good-quality Sarawak sago flour does possess valuable properties for certain industrial purposes that are not possessed by other starches; such flour can be produced cheaply and, provided simple technical precautions are observed in its processing, transport and storage, there seems little doubt that it could continue to compete successfully in the highly competitive world starch markets.

The local sago industry is now in a most depressed condition and this is having an unfortunate effect on the Melanau community, who are largely dependent on the sago industry; there are, unfortunately, complicated social and economic difficulties to be solved before development of the industry is possible on the technical lines that have been established by the Department of Agriculture.

## Pepper

This was an important export product for many years before the war. Quality was excellent and the best grades commanded the high prices offered in the world markets. During the Japanese occupation practically all the gardens were abandoned, but there has been a remarkable recovery in the industry and production now far exceeds prewar levels. Before the war most of the vines were planted in small gardens often less than half an acre in extent, but recently there has been a tendency to amalgamate into larger units. The gardens are most intensively cultivated and large quantities of manures and pesticides are used; many of the gardeners are progressive farmers and there has been recently an increasing tendency on their part to use artificial fertilisers and modern pesticides. The industry is still mainly in Chinese hands, but Dayaks are showing interest in the crop.

The total exports of pepper (both black and white) in 1954 broke all records for the country at 15,022 tons. Prices maintained a higher level than was generally expected.

Prewar Sarawak produced mainly white pepper, because it was a more valuable product than black, though more difficult to make. Since the war the margin between the prices offered for the two types has tended to close; this has been reflected in the increasing proportion of black produced, and in 1954 approximately 80% of the exports were black pepper. The change in demand is probably due to the fact that increasing quantities of pepper are apparently processed into concentrated flavourings and preservatives for the canned-meat trade.

A serious unidentified root disease that has been called the 'sudden death' disease is causing increasing damage to some of the most productive pepper gardens. Funds have been made available for a research scheme under the Department of Agriculture's control to investigate the matter.

## Coconuts

Coconuts are mainly a smallholder crop and largely confined to the First Division. The total acreage is estimated at only 21,000 acres and many of the palms are old and in very poor condition. Some copra is exported, but the quality is usually very low. The Department has worked out simple methods of producing better-quality copra.

## Maize, Job's tears, ragi, Italian millet and sorghum

All these cereal crops are grown to a small extent and frequently interplanted in the hill padi crops. They are usually only regarded as a substitute for padi in times of emergency and as poultry food.

### Sweet potatoes, tapioca and yams

These crops are grown throughout the country for use as vegetables and as substitutes for rice in times of shortage.

### Fresh vegetables

Production, except by some Chinese market gardeners near the towns, is only on a small scale. A fair variety of tropical vegetables can be grown, though exceptionally heavy rainfall at times hinders intensive cultivation. The production of some temperate-climate vegetables is possible in parts of the uplands.

### Fruit trees

Fruit trees are found in the villages, but the demand for fruit exceeds the supply and there is considerable scope for further planting of bananas, durian, rambutan, mangosteen and so on. The production of young fruit trees for sale to farmers and gardeners receives the attention of the Department as far as more important work allows.

### Pineapples

Pineapples will grow on most types of soil in Sarawak, and fruit of high quality and exceptional flavour can be produced on the drained peat soils. No attempt has been made to develop a canned-pineapple-product industry, as it has been decided that Sarawak would probably find it impossible to compete successfully in the world markets.

### Coffee

Coffee is cultivated to a small extent near the villages for local consumption. Sarawak still imports a large proportion of its supplies of coffee and, owing to high prices, increased interest has recently been taken in planting coffee. The Department generally advises the planting of the Robusta type and is producing large numbers of seedlings of this type for sale to farmers.

### Tobacco

Tobacco for local consumption is planted in small areas near the villages. The quality of the product is generally poor and Sarawak's climate does not generally seem favourable for the production of good-quality tobacco.

*Typical Land Dayak hill padi farm near Tarat, First Division*

### Cocoa

This crop is not yet cultivated by farmers in Sarawak, but some observation plots established by the Department of Agriculture show some promise on the better type of soils, particularly when fertilisers are used. Seedlings raised in quarantine in Malaya from clean, selected seed obtained from the Gold Coast have been planted at one of the Department's centres and are now in full bearing. Seedlings raised from the pods are being distributed for planting at selected centres. Some difficulty is being experienced in production of marketable cocoa and it is possible that successful production may only be possible in Sarawak's climate under carefully controlled factory conditions.

## *Other Industries*

Apart from poultry and goats, which are widely kept throughout the territory, livestock husbandry does not as yet play a major part in the rural economy of Sarawak. Some buffaloes are kept in the north and are commonly used for the cultivation by trampling of wet padi land and this simple method is surprisingly effective; so far little interest has been shown in the use of buffalo-drawn implements. Buffaloes are kept at the Department's development centres and are doing quite well apart from very real risks of severe losses that could occur during the disastrous floods that are a feature of the climate.

*Cattle.*—The cattle population of Sarawak is quite small, although it would appear that there are more herds of cattle in the coastal areas than was at one time thought. Attempts are being made to improve these herds with imported Red Sindhi and Kelantan (Malaya) blood. The Bali breed of cattle are proving successful in Sarawak, even under the most difficult conditions, and provided the meat from these beasts does prove generally acceptable to the local population they may prove to be the best basis for development of cattle husbandry.

*Pigs.*—Pigs are kept by Chinese farmers and to some extent by the Dayaks, but local production of pork is inadequate to cope with the demand, and there are still considerable imports of live pigs into Sarawak. The Department is making efforts to improve production and its plans, for the time being at least, are largely based on Middle White crosses. Middle White crosses both on Chinese and Dayak breeds do seem very suitable for Sarawak conditions. Limited imports of pedigree Middle White pigs are made by the Department from England. The Department is also paying considerable attention to the improvement of standards of feeding, which are generally low.

The Veterinary Officer appointed in

*Balinese cow at a departmental development centre*

1953 has been able to make considerable progress with a survey of the livestock-disease problems of the territory. Certain serious diseases have definitely been identified and may well be the major reason why livestock husbandry has not developed to a greater extent in the past.

## Fisheries

Fish is a staple article of diet for a large proportion of Sarawak's population and both marine and fresh water fisheries are important. The main fishing grounds are the shallow coastal waters and the estuaries of the larger rivers.

The fishing methods used along the coasts may appear crude to the casual observer, but anyone acquainted with sea fishing is soon impressed by the simplicity, ingenuity and suitability for local conditions of the contrivances used. The local fishermen display considerable skill and are generally very good seamen.

The fisheries section of the Department operates a small motor fishing vessel. The best results are now being obtained with a Danish seine and a local design of fish-trap known as the *bubu*, which has been modified and improved. The Danish seine is generally proving successful during the fair-weather season and the *bubus* are generally successful during the north-east monsoon.

Considerable attention is being paid by the Department of Agriculture to fish-marketing problems and simple cold-storage facilities for its own catches have been arranged. Surplus low-grade fish caught by the vessel are now generally made into high-grade fish-meal at an experimental plant operated by the Department; the fish-meal is proving to be a valuable pig food.

Chinese fish farmers regularly obtain large and profitable yields of fresh-water fish from their ponds, which are often combined with pig and vegetable farming. With the exception of the common carp, the usual types of fish used do not breed in Sarawak and, therefore, the industry requires regular importation of fry; this limits development of this industry to the more accessible areas. The Department some time ago introduced some *Tillapia mozambica*, and the importation is proving most successful, as this introduced species breeds profusely in Sarawak and fattens to a palatable fish that is acceptable locally.

## *Summary*

Three-quarters of Sarawak's approximate 47,000 sq. miles is still under primary jungle. The terrain is difficult and passes abruptly from the peat swamps of the coastal areas to the steep hills of the interior. Soils are generally poor. Climate is equatorial, with exceptionally heavy rainfall during the north-east monsoon. Population totals only about 550,000.

In the past rural industries have been largely based on small, individual native farmers and the policy has been to encourage this type of agriculture rather than large, specialised plantations based on daily paid labour. It is now realised that sufficiently rapid progress cannot be made on the old basis and establishment of ' group farming ' projects is essential for economic survival of the farmers.

Padi is the chief crop; both hill padi and swamp padi are grown, but the standard of cultivation is not high. Till recently rubber was the chief cash crop, but the trees are generally old seedlings in poor condition and large-scale replanting is urgently necessary; quality of the product is generally poor. Pepper has recently become a more important export than rubber and is widely grown in small intensive gardens. Sago flour is also exported.

The Department of Agriculture is hindered by acute staff shortages, but is making successful efforts to improve the standard of padi cultivation and to rehabilitate the rubber industry.

Livestock husbandry at present only plays a minor part in the country's rural economy. The Department is paying special attention to development of pig farming based on Middle White crosses. Buffaloes and Bali cattle will also receive particular attention. Disease surveys are now taking place in charge of a veterinary officer, and it appears that certain diseases may have been a major reason for lack of development in the past.

The Department of Agriculture is also responsible for fisheries and operates an experimental fishing vessel and fish-meal plant with some success. Fish farming is an important industry in the hands of Chinese farmers; the Department is obtaining considerable success with introductions of *Tillapia mozambica*.

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*Note.*—The ' Sarawak Annual Report ' contains a selected list of references to general literature on Sarawak.

*Photos: Sarawak Government Information Service*

# Present Conditions and Future Outlook for French Agriculture

MAURICE LENGELLE
(*Membre du Conseil Supérieur de l'Agriculture*)

*M. Lengellé has provided an authoritative account of recent trends in French agriculture. Many striking changes have been made in various fields of production and the decrease in the acreage devoted to beetroot follows on the Government's plan to discourage alcohol production and consumption. M. Lengellé has agreed to provide regular six-monthly reports.*

FOR some years now there have been signs of increasing productivity in French agriculture. This accomplishment is being made with three main points in view: (*a*) the rational utilisation of resources, (*b*) the maintenance, and if possible the increase, of purchasing power by an important part of the population and (*c*) a search for methods of lowering agricultural costs.

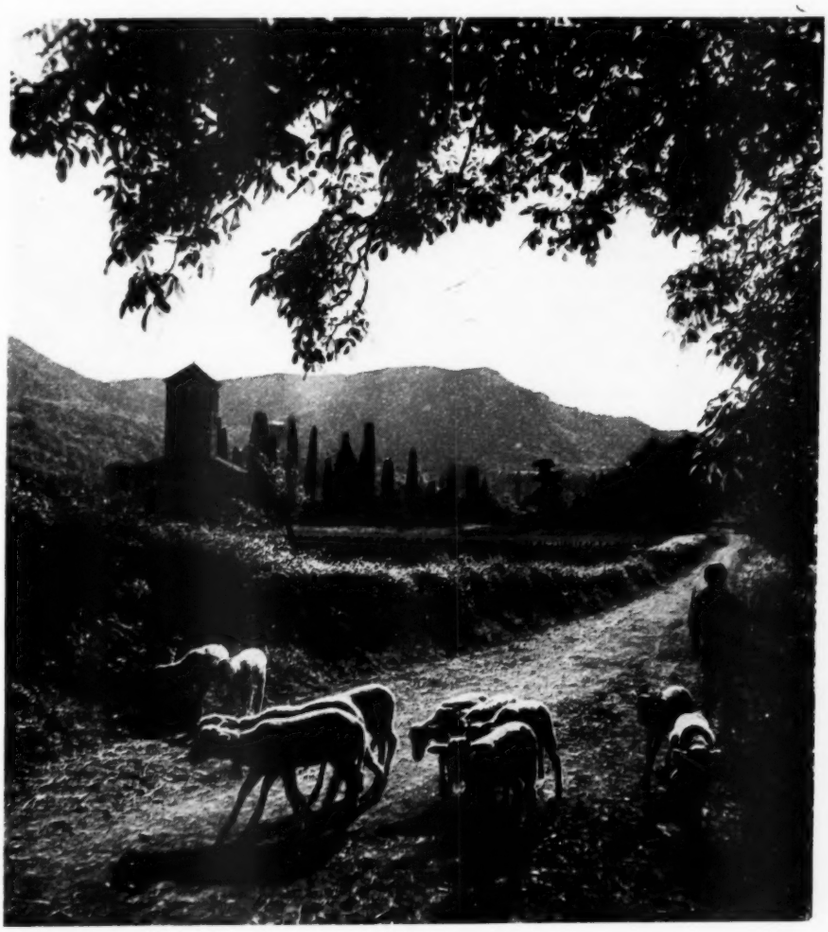
It is generally known that France possesses some of the best loamy soils in Western Europe, and her Atlantic regions are well endowed for cattle breeding. The Mediterranean plains, the valleys of the Loire, the Garonne and the Rhône (together with their tributaries) represent the equivalent of two or three Californias in a country only a fourteenth of the size of the U.S.A.

Of the 16 nations united under the Marshall Plan, later the Organisation for European Economic Co-operation, France is the country (with the exception of Belgium and Holland) most able to increase her productivity.

For her part, France supports an important rural population of 43 million people, of whom 10 millions are farm owners. This figure attracts attention, for many of these farmers, living on the soil of their ancestors, eke out a miserable existence with no thought of increasing productivity. Their condition contrasts strongly with that of the industrial population, particularly in Paris and the North.[1] The average farmer is not able to envisage an improvement (however necessary) in his level of life. French political economics, which are striving for expansion without inflation, considers all methods, including price control (particularly in goods of agricultural origin), as fair. As in all other Western countries, the terms of trade for agriculture are deteriorating and there seems little hope of redress. The only solution offered to the French peasant is an increase in production, which will make for lower prices. Fortunately, there are indications that this is already happening and the increased production is being utilised by increases in home consumption and export.

Local tractor production was doubled between 1953 and 1954 and is a logical phase in the present development plan.

The many economic problems now confronting French agriculture have made it necessary to survey the fundamental elements of marketing, and it is well that farmers are more and more anxious to be informed of the future outlets that will be offered to them. Before deciding on any change they usually consider the effects of future



*There were 7,675,000 sheep in France in 1952-53. The figure has changed very little since 1947-48, but shows a decrease of about two millions on the pre-war figure*

*A family occupation. Picking olives at St. Jean de Fos (Hérault)*

changes in the economy. Their proverbial anxiety for guaranteed prices is lessening and a spirit of speculation is gaining ground. The present situation in the markets for raw materials for alcohol production (*i.e.* vines and beetroot) has forced the peasant to consider growing other crops.[2] This has been called a 'reconversion' in French agriculture and its effects on future production will contain some surprises.

The principal handicap in French agriculture is the lack of authoritative statistics. Attempts were made to provide statistics with the aid of individual questionnaires, but this, unfortunately, was discontinued during the war. This system gave way to a new system which provides figures dating from the beginning of the present century. If results seem to be excellent for crops that are utilised immediately (*e.g.* wheat), they are less so for fodder crops (*e.g.* maize, and particularly potatoes), and frankly mediocre in the case of livestock production (milk and meat; official figures are not available). The figures quoted in this article were provided by various reporters for the Conseil de l'Agriculture and the Comité d'Etudes de l'Intégration de la Zone Franc, the president of which is General Corniglion-Moliner. A project of reformation, utilising the available figures, is under way, but in the meantime it is the Comité de l'Intégration who supplies the production figures etc.

## Cereals

The decrease in the number of horses has involved a similar decrease in the production of oats, whereas the production of other cereals has increased (see Table 1).

The progressive decrease in the consumption of cereal products (*e.g.* bread) has provoked an unusual crisis in the milling trade.

Rice culture has been developed in the island of Camargue; yields have been high and imports of polished rice into France have fallen from 600,000 metric tons before the war to about 30,000 metric tons.

## Animal production

Striking progress has been made with animal production. The reports of M. Veisseyre, of the Conseil Supérieur de l'Agriculture, and M. Boussingault, of the Centre de Recherches et de Documentation sur la Consommation, have shown that in 1954 France had produced more than 200 million hectolitres of milk and almost 2,500,000 metric tons of meat. French production of animal fats has attained a peak of 600,000 metric tons. It is thus true to say that France was, after the U.S.A. and the U.S.S.R., the third highest producer of animal products in 1954. French holdings devoted solely to animal breeding are few, but there are very few agriculturists who do not rear some livestock. It is estimated that the total area used for producing animal feeding-stuffs is double that utilised for direct consumption products.

About 15 years ago peasants produced meat only for their own consumption, but production has now risen, particularly with pigs and poultry. The supply to the national market of animals from small farms is considerable. The traditional crop-growing districts of Charollais and Limousin do not follow this general trend, but on the other hand, it must be remembered that crop growing is increasing. Many of these animals are dual-purpose animals, serving as harness beasts before they are slaughtered and sold on the national markets.

It is believed that, in fact, there will be a surplus of meat, making for a fall in prices and perhaps forcing traditional breeders to carry less stock.

At the end of autumn 1953, following huge sales of beef products, sales almost ceased, as many cattle had contracted foot-and-mouth disease. Production was better in 1954 (2,400,000 metric tons), more than was necessary for home consumption. But it is necessary to stabilise production and to find sufficient outlets for it.

Another difficulty stems from the eating habits of the French themselves, for they have become a nation of roast meat eaters. But a firm export trade in meat has been developed with Germany.

Table 2 shows the meat production between 1949 and 1954.

TABLE 1

| | *Area, thousands of ha.* | | *Yields, quintals per ha.* | | *Production, thousands of metric tons* | |
|---|---|---|---|---|---|---|
| | 1934–38 | 1954 | 1934–38 | 1954 | 1934–38 | 1954 |
| Wheat .. | 5,224 | 4,150 | 15.6 | 21 | 8,143 | 8,800 |
| Oats .. | 3,278 | 2,138 | 13.9 | 17 | 4,472 | 3,565 |
| Barley .. | 742 | 1,242 | 14.5 | 20 | 1,074 | 2,522 |
| Maize .. | 342 | 405 | 15.8 | 21 | 541 | 871 |
| Rye .. | 663 | 410 | 11.6 | 11.3 | 769 | 464 |
| Rice .. | — | 19 | — | 35 | — | 68 |

## Milk products

As to milk and milk products, wild estimates have been made concerning the total volume of production. My colleague, M. Veisseyre, proposed the figure of 200 million hectolitres per annum recently,[3] corresponding to 350,000 metric tons of butter and an equal quantity of cheese. The former accepted figure was 150 million hectolitres for 1952. In order to establish his figure, M. Veisseyre compared the figures of production obtained from inquiries into family budgets. This considerable difference can be explained by one of two things: (*a*) the number of milking cows had been largely under-estimated or (*b*) the yields of milk per cow were superior to those that had been given earlier. The first hypothesis is perhaps more correct. It corresponds to figures given above for production of meat. On the other hand, the French livestock breeder uses dual-purpose animals—that is, for milk and for meat—and thus there is steady fluidity between the two markets (*i.e.* meat and milk), which is accentuated even more in France than in other countries; nevertheless it is certain that the yields of milking cows are improving.

Efforts are being made to use artificial insemination to increase, in a positive way, the ultimate production figures. Milk products are among those that best swell the coffers of French agriculturists and it is reasonable to suppose that no one circumstance will bring about a decrease in production. A positive decrease in prices will probably incite them to increase their supply, in order to maintain their revenue at a constant level.[4]

The yield of milk from the average French cow, about 2,500 l. in 1952, is now about 3,000 l. per year. (This is comparable to Belgian yields.) When applied to 10 million cows, this increase of 500 l. offers a surplus estimated at 50 million hectolitres. It is expected that this surplus will appear in the form of 50,000 to 100,000 metric tons of butter. This will be difficult to absorb on the home market, for the Frenchman is already one of the greatest consumers of butter in the entire world (8 to 9 kg.) and he is tending to increase his consumption of margarine. The situation is sufficiently serious to attract the attention of public authorities, who are anxious to maintain agricultural revenue. It is due only to an increase in yields of the order that has been indicated above that French agriculture has been able to compete with world markets, but, on the other hand, the production follows an ascending curve and surpasses the market capacity. Animal production is also an important source of fat materials and whereas the world consumes two-thirds of its fat in the form of vegetable fats, the proportion is exactly inversed in France.

*Peasant cultivation in the Haute Garonne, south-west France*

TABLE 2

| *Year* | *Beef* | *Veal* | *Mutton* | *Pork* | *Horse* |
|---|---|---|---|---|---|
| | | | *Number of animals slaughtered (thousands)* | | |
| 1949 | 2,700 | 5,510 | 7,540 | 9,747 | 238 |
| 1950 | 2,780 | 5,576 | 7,540 | 10,395 | 237 |
| 1951 | 2,760 | 5,590 | 7,540 | 9,675 | 253 |
| 1952 | 2,840 | 4,740 | 7,692 | 10,897 | 279 |
| 1953 | 2,735 | 5,357 | 8,000 | 11,948 | 279 |
| 1954 | NA* | 6,300 | 8,000 | NA | 314 |
| | | | *Average net weight (kg.)* | | |
| 1949 | 250 | 51 | 13 | 78 | 252 |
| 1950 | 255 | 52 | 13 | 76 | 274 |
| 1951 | 264 | 52 | 13 | 77 | 277 |
| 1952 | 271 | 54 | 13 | 78 | 287 |
| 1953 | 306 | 55 | 13 | 77 | 287 |
| 1954 | NA | 56 | 13 | NA | 287 |
| | | | *Tonnage (thousands)* | | |
| 1949 | 676 | 280 | 100 | 770 | 60 |
| 1950 | 711 | 300 | 100 | 790 | 65 |
| 1951 | 730 | 264 | 100 | 745 | 70 |
| 1952 | 760 | 273 | 105 | 850 | 80 |
| 1953 | 837 | 323 | 110 | 920 | 80 |
| 1954 | 1,000 | 360 | 110 | 900 | 90 |

Source: Boussingault, A.: ' La dépense de la viande en France ', Centre de Recherches et de Documentation sur la Consommation, May 1955.

* NA = not available.

## Fats and oils

The development of animal production involves important supplementary resources of suet and lard, which contend with vegetable fats for soap-making. Despite the striking develop-

ment of detergents (which captured a quarter of the soap market in 1954), we should utilise soaps richer in animal fats, like most of the Anglo-Saxon countries.[5]

The continued decline in production of walnut oil and olive oil should also be noted. This trend is explained by the increased use of motorised machinery, which is not usable in olive groves etc. Although there is a strong demand for wood of this category for furniture-making, production costs are too high. On the other hand, it is expected that the rape crop in the present year (1955) will be large, French agriculturists having substituted rape for wheat and beetroot in their efforts to find products more suitable to French needs. From 1934–38 to 1954 the area devoted to rape increased from 12,000 to 60,000 ha., with yields of 13,000 and 100,000 metric tons respectively. It is believed that the present results can be tripled.

### Conclusions

The recent trends have confirmed that there is a bright future for French agriculture. It was last year (1954), for the first time, that the agricultural balance of this country, traditionally in debt, showed a credit. Two solutions are offered for maintaining and increasing French agricultural progress. The first, taking into consideration our high prices and the possibilities in the industrial world, is to curtail progressively our agriculture, as was done by other countries who had achieved the same standard of evolution and progress. The second solution is concerned with the fact that marginal agricultural prices are largely below average; that is to say, higher productivity will entail a decrease in the cost of production. On the other hand, experience shows that it is difficult to control the volume of production. And so it is for this reason that, for at least a few years, all efforts to increase productivity will be expressed by increasing available resources.

Certain experts have argued in this matter as if our agriculture was, in future, to be an export industry in the European cadre. Some suggest, too, that France should eventually be in a position to act as the larder of Europe. It is evident that such an objective will only be attained with the aid of rigorous organisation and efficient techniques; reflection on such problems impresses a new character on French agriculture.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*Photos: French Government Tourist Office, London*

## Stock Feeds

The production of two new fish products for the farming community was announced in London recently. The first of these products is ' Super Solvitax ', a stabilised, winterised, vitamin-rich pure cod-liver oil for feeding to farm stock; it is being produced by British Cod Liver Oils (Hull and Grimsby) Ltd. The product contains special antioxidants which ensure that it retains full natural vitamin-A and -D potency and remains absolutely fresh, even when stored as long as two years. ' Super Solvitax ' is also winterised by cold filtration for easy mixing in frosty weather. This process removes the fatty stearins which cause some cod-liver oils to thicken at low temperature.

The announcement of the second product was made by the White Fish Meal Manufacturers, of Hull and Grimsby, who said that they were pooling their resources to market a new pure white-fish meal which will be the first in the world to carry a triple guarantee of quality. It will be sold under the brand name ' Provimi 66 '.

### Production

The Hull factory is the biggest producer of white-fish meal in the world with an annual output of 35,000–40,000 tons. The Grimsby plant is the second biggest in Britain, producing 25,000–30,000 tons annually. Together the factories produce about 70% of the white-fish meal manufactured in Britain. Protein percentage is guaranteed to be at least 66%; oil content is guaranteed to be less than 4%; and salt is guaranteed to be less than 2%.

## Fertiliser Factory Expansion

It was announced recently that African Explosives and Chemical Industries (Rhodesia) Ltd. are about to extend their Rodia factory, near Salisbury, at a capital cost of over £3 million, to make the Federation independent of imported fertilisers by 1958. Plans have been completed to go ahead with the manufacture of superphosphates, and plant from Europe will be installed in the near future. The plant extensions should be completed by about 1958. The company will continue with the manufacture of compound fertilisers. With the installation of a granulation plant it will produce fertiliser products in both powder and granular form.

Superphosphate has hitherto been imported from the Union of South Africa and from overseas, but the new plant in Southern Rhodesia will have an initial capacity sufficient to meet the full requirements of the Federation for some years to come.

### Prices

The superphosphate project includes both phosphoric acid and sulphuric acid plants, and for the latter the raw material will be pyrites mined in Southern Rhodesia. A spokesman for the company said that prices of the locally manufactured products would be competitive with the imported ones. The big advantage would be in the stabilisation of the fertiliser position in the Federation.

### Capacity

When the factory was completed it would have a production capacity of 150,000 tons a year. One direct result of the extensions to the factory would be the spending of £1 million locally that would otherwise have gone out of the country to pay for imports, and to that extent the balance-of-payments position would be eased for the Federation. As far as possible local raw materials would be used. The only imported ones would be phosphate rock, nitrogen and potash. When the factory was in full operation it would work 24 hours a day, seven days a week. It would mean employment for approximately 40 additional Europeans and 150 additional Africans.

# Agricultural Crops in Hawaii—I

ALAN THISTLE

*(Division Director, Board of Commissioners of Agriculture and Forestry, Territory of Hawaii)*

*At the mention of Hawaii most people think of waving coconut palms and blue-green surf crashing on sunlit coral strands. Few realise that there are not many agricultural communities in the world that have attained as high a standard of production from the soil as Hawaii. The pineapple has become as much a symbol of the islands as soft rhythmic music and the flower ' lei '. A land of sunshine and flowers, Hawaii is also a land of rain and cane. The vegetation ranges from lush, tropical rain forests to lichen-covered lava wastes.*

SEVEN of the 20 islands and islets, which comprise the Hawaiian archipelago, are inhabited. Areas on six are used for commercial crop production.

Practically all the land where terrain, soil depth and rainfall is suitable, or where irrigation could be economically developed, has been brought under intensive cultivation. This amounts to only 7·5% of the total land area of approximately 4,100,000 acres, but crop production from this accounts for almost 90% of the total agricultural income. Of the land area 38% is not suitable for cultivation and is used for pasture or range and 26% is considered essential for the protection of the water supply for both agricultural and domestic purposes and is set aside in forest reserves. The balance, amounting to approximately one million acres, is in parks, cities, roads, military establishments and waste.

About 40% of all land is owned by 50 large, private land-owners; 42% is territorial, Federal or other public land, and 18% is owned by other private owners.

## Crops and climate

*Crops.*—On the cultivated areas the principal crops are sugar-cane and pineapple. These are of primary importance to the economy of Hawaii, having a yearly production value of $150 million and $100 million respectively. Slightly more than 220,000 acres are under sugar-cane and 73,000 acres under pineapple.

Other crops of economic importance are: fresh vegetables (6,000 acres); coffee (4,000 acres); fruit orchards (2,000 acres); macadamia nuts (1,750 acres); taro (1,000 acres); field crops, *i.e.* rice, corn, peanuts, dry beans (1,000 acres).

Taro is produced for the manufacture of ' poi ', which is a starch food, consumed locally. It replaces potatoes, rice etc. in the diet.

Of importance also is the production of cut flowers and tropical foliage for local sale and for export.

*Food imports.*—Most of the staple foods consumed in Hawaii are imported from the mainland of the U.S.A. For a large majority of the population rice is the staple diet, but only 1% is grown locally. Rice imports, mostly from California, amount to over 60 million lb. per year.

Local production of fresh vegetables, fruits (except pineapple), livestock and poultry products is supplemented by imports, which amount to approximately 45% of the total volume consumed.

*Climate.*—Lying within the Torrid Zone, the climate of the inhabited islands is tempered by the North-East Trade Winds. An extremely wide range of temperature, rainfall and humidity prevails, depending on elevation and exposure to the winds. Temperatures range from 25° F. on

*Sugar-cane seed pieces prepared for hot fungicidal dip treatment*

the highest peak (13,784 ft.) to 98° F. on some arid, leeward shores. Rainfall ranges from more than 450 in. to less than 5 in. per year. Honolulu's mean temperature ranges from 72° F. in January to 78.5° F. in August. The average daily variation is only 9.3° F.

*Labour.*—Approximately 31,000 persons of a work force of 190,000 are employed by the sugar and pineapple plantations. They are considered to be the highest paid agricultural labourers in the world, on a 'year round' basis. The daily wage is almost double the U.S. national average for agricultural labour. Non-plantation farming makes up only about one-seventh of the total agricultural payroll although it has been increasing in relative importance in recent years.

## The Sugar Industry

*General.*—The production of sugar-cane has been Hawaii's most important industry since 1860. Cane is grown on four islands and covers approximately 220,000 acres.

At present the industry is comprised of 28 separate plantation companies owning or leasing their land and operating individual mills. There are also approximately 2,000 independent cane planters who sell their cane to the various plantation companies. Total, annual, raw sugar (96°) production is slightly more than one million short tons or about 25% of U.S. production (3% of world production).

The plantation companies employ approximately 20,000 persons on a year round basis with an annual payroll of more than $62 million. Average daily pay is almost $11.00.

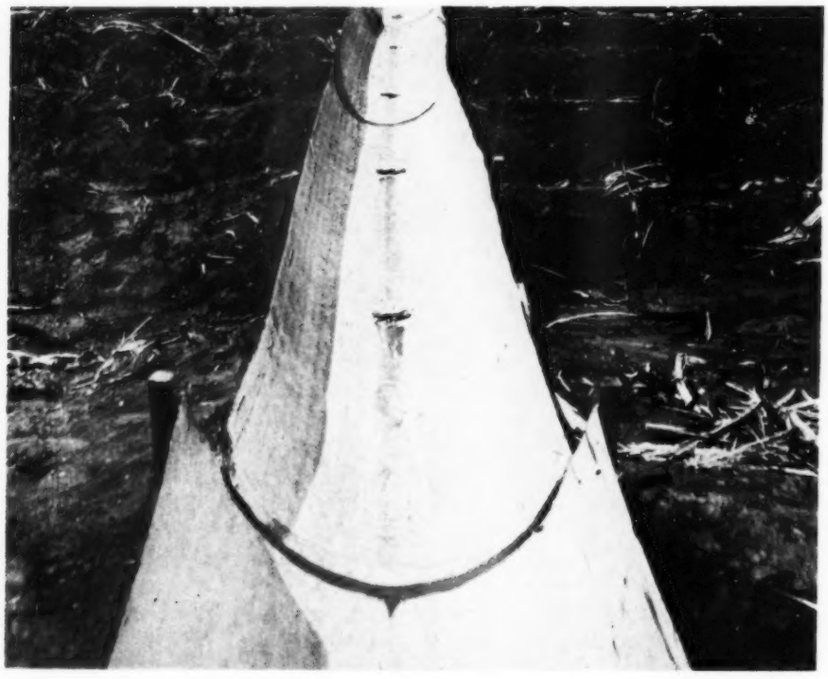
Although in recent years sugar production has remained almost static, the use of manual labour has declined in some instances by more than 50%. This reduction has been brought about by ingenious labour-saving devices, new methods and modern materials.

The sugar industry supports its own research institution, known as the Experiment Station of the Hawaiian Sugar Planters' Association (H.S.P.A.). The industry owns a refinery and marketing organisation in California. There is also a jointly owned smaller refinery near Honolulu, refining primarily for local consumption.

### Research

The H.S.P.A. was originally established as an agency for the importation of foreign agricultural labour. Such immigration was necessary because the native Hawaiians were not adaptable to plantation work. Many thousands of Chinese, Japanese, Portuguese, Spanish, Germans, Puerto Ricans and Filipinos were offered contracts in their native countries by H.S.P.A. or plantation agents for work in Hawaii's sugar-cane fields. Most of these immigrants have made Hawaii their home and have inter-married with each other, with the native Hawaiians and with immigrants from the U.S. mainland.

At about the turn of the present century, a serious insect pest, the sugar-cane leaf-hopper, gained entry to the Territory, probably from Australia. This insect threatened continued economical cane production. The Experiment Station was expanded to include a Department of Entomology, and scientists were employed to search the native home of the pest for its natural enemies. This co-operative venture was so successful that the plantation companies expanded the Experiment Station to include Departments of Plant Pathology, Genetics, Agronomy, Chemistry, Agricultural Engineering, By-Products, Sugar Technology, Physiology, Biochemistry and Agricultural Statistics.



*Aluminium flume used in 'continuous' long-line system of irrigating sugar-cane. Water enters furrows through orifices in bottom of flume*

### Cropping and yields

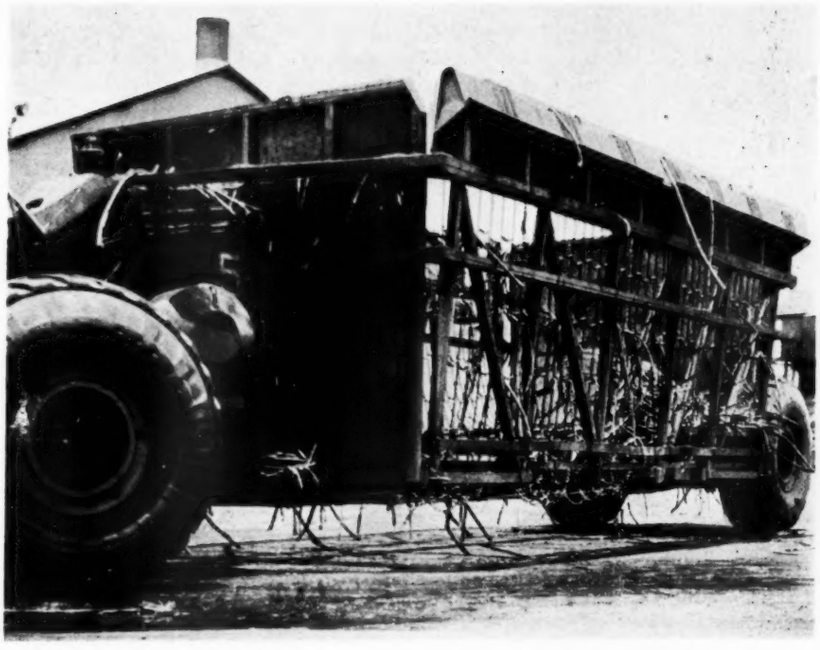
For the most part, sugar-cane follows sugar-cane on the same land with no fallow period, green manuring or crop rotation. Some fields have grown cane crops in this manner for 50 or more years. Crop cycles range from 18 to 24 months, yielding 4 to 6 harvests from the original planting. Average yields per acre for the industry are about 10.5 short tons of raw sugar from 85 short tons of cane. Yields from some of the better irrigated land are often as high as 19–20 short tons of sugar from 160–165 tons of cane per acre. Yields have not declined with the constant cropping; rather, they have steadily increased with improved varieties, better weed control, and improved irrigation and fertiliser practices.

### Land preparation and planting

Most of the land under sugar-cane is composed of soils from weathered lava rock. In preparation for planting it is usually broken up with deep-

riding sub-soilers, ploughed to a depth of 2–4 ft., harrowed and dragged. With few exceptions, all such equipment is drawn by crawler-type gasoline-, or diesel-oil-powered tractors.

Planting is accomplished by using 10–24-in. sections of the sugar-cane stalk of the desired variety. In most instances, the seed pieces are treated in hot fungicidal solutions before planting. Machines have been developed that cut the furrows, deposit a band of fertilisers, and drop a continuous line of seed pieces, covering them with 2–3 in. of soil. These machines are mounted on large crawler-type tractors and are manned by three workers: a driver, and two persons who feed the seed pieces into the two furrows which are cut by mould-board plough as the machine moves along. Planting is usually contour-wise.



*Vehicle used to transport cane from field to mill. It carries up to 40 short tons*

### Fertilisers

Fertiliser, mostly inorganic, is applied in relatively high amounts—200–250 lb. of nitrogen, 50–200 lb. of potash, and 50–200 lb. of phosphoric acid per acre for each crop cycle. Most of the phosphate is applied with the seed pieces or when the field is ratooned, and the nitrogen and potash are applied in 3–4 applications during the first 12–16 months. After the cane has 'closed in' or lodged, the water-soluble nitrogen, potash fertilisers and, in some instances, phosphates are applied in the irrigation water or in foliar sprays from low-flying aircraft.

### Irrigation

Approximately 53% of the sugar production is from irrigated fields. Almost $50 million of the $175 million in capital investments of the sugar companies are invested in irrigation facilities. Surface water is carried in ditches, pipe lines and through tunnels from the wet windward slopes of the islands to the dry leeward areas, where the best yields and quality-ratios are obtained. Considerable water is also obtained from free-flowing wells, or is pumped from artesian basins found under the islands. These basins are a unique occurrence of underground fresh water. They are found in the form of a subterranean lenses, sometimes more than 1,000 ft. thick, which float on the sea-water permeating the porous rock structure underlying the islands. Other water is obtained by tunnelling into the geological 'dyke' systems, which impound infiltrated rain water and forest drip, high in the mountains. The irrigated plantations have earthen reservoirs for water storage and field distribution. Four to five million gallons of water are applied in 15–20 applications to produce one acre of cane.

On many plantations, the irrigation interval is determined by burying small plaster-of-paris blocks at intervals throughout the field. The blocks are wired to the field edges. Soil moisture is determined by metering the amount of electricity the blocks will conduct.

Water is brought to the fields in open supply ditches and carried through the fields in level ditches spaced 100–150 ft. or more apart. The level ditches then supply concrete or aluminium flumes or earthen ditches, which are placed down the slopes 300–400 ft. apart. Water is removed from the flumes or ditches into each furrow by individual gates in the sides, by metal or canvas syphons or through holes in the bottoms of the flumes. Under some field-irrigation systems one man may irrigate as many as 25 acres in one eight-hour day.

### Cultivation and weed control

Little or no cultivation or hoeing is practised. Weeds are controlled almost before they can be seen by the use of such chemicals as 2,4-D, 2,4,5-T, CMU, sodium TCA, dinitro and substituted urea compounds, activated aromatic oil emulsions and by combinations of these materials. These chemicals are applied from low-flying aircraft, from broadcast or individual-furrow spray equipment mounted on crawler- and wheel-type tractors, and by individual knapsack sprayers. Knapsack sprayers are often charged and pressurised from road-side equipment *via* long portable field hoses.

### Pest and disease control

Other than for research the sugar industry spends no money for insect or disease control except for seed-piece treatment. The principal insect pests are all controlled by their natural enemies, imported from the native habitats of the individual pests. Sugar-cane diseases are controlled through the planting of disease-resistant strains and varieties developed by the H.S.P.A.'s Genetics and Plant Pathology Departments, and by hot fungicidal treatment of the planting material.

Rodents (rats and mice) are a problem but are normally held under

excellent control through the use of warfarin, zinc phosphate and, until recently, by thallium sulphate. Most plantations use a ' pre-baiting ' system under which feeding stations are established at a predetermined spacing throughout the fields. These stations are supplied with unpoisoned grains or other baits. When it is determined that the rodent population is feeding freely at the stations (usually about one week) the unpoisoned bait is substituted by a poisoned one. In most instances, two or at most three ' pre-baitings ' (4 to 5 months apart) are required per crop cycle, even in heavily infested areas.

### Harvesting

Except in some of the wetter, unirrigated areas, the cane fields are burned over immediately before the harvest. This eliminates the dry leaves and much of the cane top. Mechanical harvesters developed in recent years have almost entirely eliminated hand-cutting and loading. This development is the principal reason for the tremendous reduction in the use of manual labour. Mechanical harvesting methods and equipment vary. On many plantations, mechanical ' grabs ' are dropped, with their jaws open, by crane-like machines into the burnt, growing cane and the jaws brought together mechanically. This action tears the stalks away from the roots at ground level. The first grab load is usually dropped into an adjacent area of growing cane and the jaws again brought together. This action is repeated until the grab load is of sufficient size (one to two short tons) to warrant loading into waiting cars, trucks or trailers. If transport is not immediately available the grab loads are windrowed and loaded later. With this method considerable replanting is often necessary especially if the soil is loose, for it permits the root systems to come away.

Another machine, mounted on crawler-type tractors, consists of a series of tines, some sharpened horizontally, which is pushed like a bulldozer into the burnt cane. By this method the stalks are sheared or broken off at ground level and pushed into windrows or piles. These are loaded into the transport by cranes using ' grabs '.

Still another method makes use of two crawler-type tractors, which pull a large rake by wire rope back and forth through the cane, piling it or windrowing it for later grab-loading.

None of these methods is satisfactory because of damage to the field and the amount of soil and debris collected with the cane. One of the industry's major projects is the development of more satisfactory mechanical harvesters.

A new, comparatively elaborate machine makes use of a series of revolving knives, both horizontal and vertical, which cut the stalks at ground level and into sections; these sections are carried by endless belts to waiting transport. Cane leaves, tops etc. are left in the field.

### Ratooning

Immediately after harvest, the furrows are reshaped. Equipment varies from disks to mould-board ploughs drawn by crawler-type tractors. Irrigation ditches are re-cut where necessary and flumes, pipes etc. are replaced. Harvested fields are irrigated as soon as it is possible and areas are replanted where damage has been done to the roots.

### Transportation

Portable field-track lines and railroad systems are almost a thing of the past. Practically all plantations use large petrol- or diesel-powered trucks and trailers, which are moved into the fields behind the harvesting equipment. Some types of transport carry as much as 40 short tons of cane per load. Most plantations have developed their own road systems and public roads are utilised only rarely.

In most instances, the transports are lined with chain or wire-rope slings. The cane is lifted mechanically from the transport by fastening on to the ends of the slings. The cane is dumped into the mill storage yard or placed directly on to the mill's cane carrier.

### Mill cleaning plants

Because of the harvesting methods, a tremendous amount of soil, rock, cane trash, roots and material other than sugar-cane stalks are transported to the mill. In wet weather this sometimes amounts to more than 50%. Harvesting methods have necessitated the development of ingenious cane-cleaning plants at each mill. Some have almost vertical, continuous belt carriers equipped with tines to allow rocks and stray pieces of metal to fall out. Others use tanks of water, treated with molasses, to raise the specific gravity, so that the cane stalks will float and the heavier material will sink. Extremely large quantities of both cold and hot water are used to flush soil and debris from the cane stalks. The stalks also pass over a series of inversely turning rollers, *i.e.* pairs of rollers spinning rapidly, one clockwise and the other counter-clockwise, toward each other across the top. The action of the rollers strips the stalks of adhering leaves and tops.

### Milling

After the stalks have passed through the cleaning plant they go through a series of shredding knives, a crusher, and a minimum of three rolling mills. Recovery of the sugar present exceeds 98% at most mills.

Juices are filtered, clarified and evaporated. The residue is converted to raw sugar and molasses in centrifugal machines.

### Transportation and marketing

Practically all plantations transport their production in large bulk-carrying trucks and trailers to bulk-sugar-storage and loading plants. These are located at the principal habours on each sugar-producing island.

Sugar refined from Hawaiian raws is marketed in 25 American States and the Territory of Alaska by the plantations' jointly owned marketing organisation (a co-operative). Marketing in the U.S. is under the control of the Sugar Act of 1948, and Hawaii's current quota is slightly over one million short tons for mainland consumption and about 45,000 short tons for local use.

### By-products

Most plantations utilise their bagasse (cane-stalk fibre and pith) for fuel to power their mills. There is one company which manufactures a fibreboard from bagasse obtained from a number of adjacent plantation mills.

*Continued on page 77*

# THE SWAZILAND IRRIGATION SCHEME–I

## Introduction

L. J. C. EVANS

(*Colonial Development Corporation*)

THE Swaziland Irrigation Scheme of the Colonial Development Corporation is situated in the low veldt of Swaziland, about 850 ft. above sea level. The area of the project is 105,000 acres, of which some 30,000 acres are expected to be irrigable. Average rainfall is about 26 in. a year and most of the rain falls during the warmer summer months—October to March. On the low veldt it is possible, with irrigation, to grow both winter and summer crops.

Since 1950 a fairly wide range of crops has been under trial. Maize and groundnuts have been grown successfully as dry-land crops during the summer, the maize being used for rations for the labour force. In 1954–55 about 600 acres of maize and 600 acres of groundnuts were grown and a rotation of maize, groundnuts and grass fallows is being worked out.

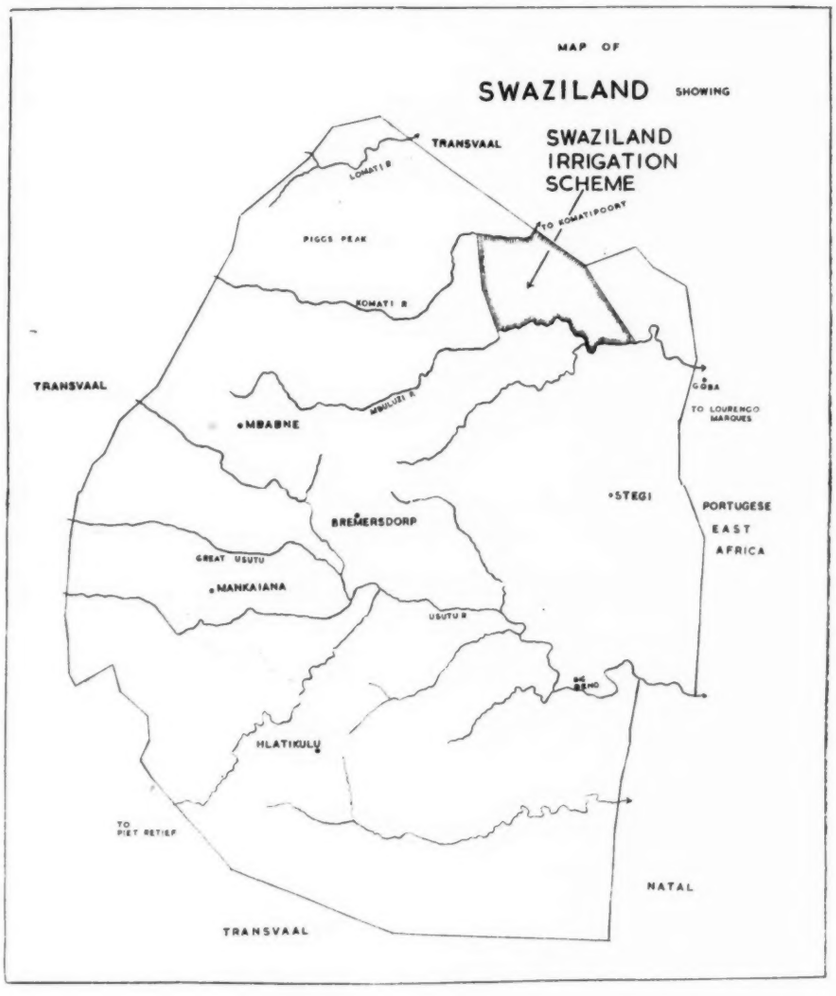
Cotton has been grown both dry and irrigated and has been tried both as a winter and as a summer crop. As was not unexpected, pests have proved troublesome and acreages under cotton are being kept small until more experience of the crop has been gained.

### Irrigation

Since 1950 experience has been gained with several crops under pumped irrigation; meanwhile surveys and plans were being made for gravity irrigation from the Komati River. The gravity canal scheme is designed in two stages; construction work on the first stage was begun in 1955.

Experiments with rice growing under irrigation were begun on small plots and subsequently the acreage was increased to nearly 2,000 acres in 1953–54. On experimental plots it proved possible to obtain yields of nearly 5 tons per acre by growing three crops (two plant crops and one ratoon crop) in 12 months, but this proved quite impracticable on a large scale. Under commercial conditions, using fully mechanised cultivation and harvesting, yields up to 2 tons per acre of paddy have been obtained. In 1954 the rice crop contained a high proportion of red grains, owing to faulty seed selection and unsatisfactory cultivation techniques; weeds also proved troublesome, especially on land that had grown rice continuously for four years. It is likely that crop rotation will be necessary and trials with a number of possible rotation crops, including soya beans, cotton, lupins, cowpeas, various forage grasses and legumes, are under way. The advantages of taking a ratoon crop of rice after the harvesting of the plant crop need further confirmation in the light of experience.

Field trials with sugar-cane have been very promising on trial plots on two different soil types, and high yields under irrigation have been obtained. Cane yields and cane-juice analyses are being recorded both for plant and ratoon crops harvested at different times of year. As irrigated winter crops, wheat and potatoes are being grown on a limited scale. Citrus fruits are potentially promising crops for this area and early plantings of both oranges and grapefruit are now coming into bearing.



### Cattle grazing

Before it was acquired by the Corporation the property was devoted to cattle ranching on a fairly extensive scale. While developing some 4,000 acres under irrigated and dry-land crops, the Corporation has also increased the number of cattle held on the project from 6,000 in 1950 to over 8,000 in 1955. Small herds of the local Nguni breed are maintained, but the majority of the cattle on the project are of the Afrikander type. Natural grazing during the summer months is excellent and conditions have been improved by provision of additional water points. More efficient pasture utilisation is being achieved by fencing and a start has been made feeding groundnut hay as supplementary forage for young stock during the winter. A profit was made on cattle operations in 1953 and 1954.

## II—Groundnut-Shell-mulching of Fallow Land

S. H. EVELYN

*(Formerly Senior Cotton Breeder, Empire Cotton Growing Corporation)*

ONE of the foremost problems confronting the agriculturist, particularly in the tropics and sub-tropics, is the improvement and maintenance of soil fertility. This problem becomes even more urgent and important when in the past no contour-bunding or other soil conservation measures nor any system of crop rotation have been employed.

In Africa and elsewhere, a fairly general practice is to crop land for six years, often with the same crop, then rest it for three years under a naturally regenerated grass-weed cover, which is incorporated with the soil when the field is next ploughed for planting. Some farmers rest their lands under elephant or other grasses and many testify to the value of leguminous cover crops. In Barbados, British West Indies, the sugar planters dry-mulch their resting fields with sugar-cane trash, and different forms of dry-mulching, including gravel, are used in other parts of the world.

On the very flat, irrigated cotton area of the Sudan Gezira, Crowther[1] showed from controlled experiments that resting land kept free from weeds subsequently produced over 40% more seed cotton than that on which weeds had been allowed to grow. On examination the weeded fallows had a much higher nitrate and moisture content than the weedy fallows. As these trials were carried out under near-desert conditions of very low rainfall, very high sun temperatures, very low relative humidity, cloudless skies, and hot drying winds, the theory that tropical soils must be protected from the burning effect of the sun for fertility to be maintained, scarcely seems tenable. Since publication of Crowther's work many countries have obtained similar results, and recently in South Africa greatly increased yields from weeded fallows have been reported from the wheat area of the Orange Free State.

*Headquarters of the Swaziland Irrigation Scheme in the bush veldt at Mananga, north-east Swaziland*

### Major factors

After careful consideration of the above, it seemed to the writer that in planning an experiment to build up and maintain soil fertility under the conditions obtaining at the Swaziland Irrigation Scheme, several major factors had to be remembered. Firstly, almost the whole cultivable area of this scheme was gently to steeply sloping and until 1951 had not been contour-bunded. Secondly, the soils contained very little organic matter, panned easily from the pounding effect of rain drops and showed a high susceptibility to erosion from both rain and wind. Thirdly, although the average annual rainfall was only 26 in., this was generally confined to the period September to March and consisted mainly of short and intense precipitations with an accordingly high run off. Fourthly, as weed control in this area is a serious problem because of the very quick natural regeneration of grasses and other weeds on fields that have even been under cultivation for fairly long periods, it was obvious that any method of discouraging the building up of weed-seed populations should pay dividends. Although dry-mulching appeared an answer to the weed problem it ruled out the use of mown grass. Finally, there was the complex effect of a dry mulch on the nitrate concentration in the soil, which, in bare soils, is generally higher during the dry periods and lower during the rains.[2]

Annually, between 500 and 600 acres of groundnuts are cultivated at this Scheme, which yield approxi-

mately one ton of dried hay and 600 lb. of shell per acre. As groundnut shell under local conditions does not break down quickly, it seemed admirable for use as a dry mulch, and it was decided to compare its effect with that of groundnut hay in the dry-mulch treatments.

An experiment was carried out between September 1952 and March 1954 on gently sloping land, which had never been contour-bunded. The soil was a red-brown doleritic loam. The history of the experiment is given below.

*History*

1947: Cleared from bush.
1948: Summer maize, no fertiliser.
1949: Summer maize, 300 lb. of super and raw phosphate (4 : 1 per acre).
1950: Summer maize, 300 lb. of super and raw phosphate (4 : 1 per acre).
1951: Summer sorghum, 300 lb. of super and raw phosphate (4 : 1 per acre).
1952: Bare fallow after sorghum crop was removed in April 1952.

*Preparation*

Disk-ploughed and harrowed in October 1952.

*Fertiliser*

None.

*Design*

Randomised block: 4 treatments; 5 replicates.

*Sub-plot area*

11 yd. × 44 yd. (0.1 acre).

*Treatments*

(1) Weedy fallow (control): natural regeneration.
(2) Bare fallow: kept continuously weeded.
(3) Dry-mulched bare fallow: Blocks 1, 2, 3, with groundnut hay, Blocks 4, 5 with groundnut shell.
(4) Dolichos bean cover-crop: *Dolichos lablab.*

The *Dolichos*, which was sown on 21 November, 1952 at a spacing of 3 ft. × 2 ft., grew excellently, covered the soil very quickly, and shed its leaves copiously in the dry season. The groundnut hay and shell mulches were put on 8 in. deep on 2 December, 1952 and raked level. The weedy fallow sub-plots were, in error, clean-weeded on 4 February, 1953, but thereafter left weedy.

*Transport of groundnuts after harvest on the Swaziland Irrigation Scheme*

## Rainfall

See Table 1. Here it is of interest to note that from 10 April to 6 September, 1953 the only precipitations recorded were as follows: 29 April, 0.09 in.; 4 May, 0.20 in.; 12 May, 0.10 in.; a total of 0.39 in. in 147 days, and yet on 6 September, 1953 the soil of the two shell-mulched sub-plots was *very wet*, and smelt like rich garden soil although very little of the shell had broken down. On the hay-mulched sub-plots the hay had completely disappeared by the end of May, and by 6 September the soil was very dry, but not cracked, whereas by the end of May the soil of the three other treatments was very dry and cracked although there was a large accumulation of shed leaves on the *Dolichos* sub-plots.

## Pests and weeds

Termites were fairly active in the hay-mulched treatment, but were not observed in the shell-mulched sub-plots. Wild game, mainly roan antelope, almost completely destroyed the green foliage and the excellent seed crop of the *Dolichos* sub-plots by the end of June in spite of shooting and the appointment of a watchman to scare them away.

Throughout the first phase of the experiment there was quite good weed growth on the weedy fallow sub-plots until these were, in error, clean-weeded on 4 February, 1953. However, a fair growth of weeds was again established on these sub-plots before September. The bare fallow was kept completely free from weeds, and the Dolichos - bean cover received two weedings before a proper canopy was formed. The hay-mulched treatment remained free from weeds until the mulch broke down and thereafter a few weeds appeared on all three sub-plots. No weeds grew on the two shell-mulched sub-plots.

## Phase II: September, 1953 to March 1954

Soon after heavy rains in October 1953 the whole experimental area was disked, cultivated and harrowed, and on 30 October drilled with Sahara variety maize as the indicator crop, at a spacing of 3 ft. × 2 ft. As the Dolichos vines and groundnut shell prevented efficient ploughing, partial

TABLE 1
MONTHLY RAINFALL, VUVULAND SECTION (INCHES)

| *Year* | *Jan.* | *Feb.* | *Mar.* | *Apr.* | *May* | *June* | *July* | *Aug.* | *Sept.* | *Oct.* | *Nov.* | *Dec.* | *Total* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1952 | 4.71 | 2.48 | 1.15 | 0.92 | 0.90 | 1.30 | 1.41 | 0.26 | 0.08 | 0.77 | 4.99 | 6.79 | 25.76 |
| 1953 | 4.51 | 3.02 | 3.83 | 0.64 | 0.30 | Nil | Nil | Nil | 1.85 | 2.92 | 7.52 | 3.52 | 28.11 |
| 1954 | 3.05 | 4.31 | 4.32 | — | — | — | — | — | — | — | — | — | — |

TABLE 2
MEASUREMENT OF MAIZE PLANTS IN FEET

| | Treatment | Block 1 | Block 2 | Block 3 | Block 4 | Block 5 | Mean height |
|---|---|---|---|---|---|---|---|
| Measured 16.12.53 | (1) Weedy fallow .. .. .. | 2.5* | 2.0 | 2.0 | 3.0 | 3.5 | 2.6 |
| | (2) Bare fallow .. .. .. | 3.5 | 4.5 | 2.0 | 3.0 | 5.0 | 3.6 |
| | (3) Dry-mulched fallow .. .. | 5.0† | 5.0† | 5.0† | 4.0‡ | 4.5‡ | 4.7 |
| | (4) Dolichos bean cover .. .. | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Measured 30.12.53 | (1) Weedy fallow .. .. .. | 5.0 | 4.0 | 4.0 | 5.0 | 7.0 | 5.0 |
| | (2) Bare fallow .. .. .. | 6.0 | 7.0 | 4.0 | 4.0 | 6.0 | 5.4 |
| | (3) Dry-mulched fallow .. .. | 8.0† | 6.0† | 7.0† | 8.0‡ | 8.0‡ | 7.4 |
| | (4) Dolichos-bean cover .. .. | 7.0 | 8.0 | 7.0 | 7.0 | 7.0 | 7.2 |

* = Purple plants (phosphate deficient)
† = Groundnut-hay-mulched fallow sub-plot
‡ = Groundnut-shell-mulched fallow sub-plot

removal of these from the plots was necessary and only about half of the former and very little of the latter were incorporated with the soil.

The germination of the maize was excellent and good stands were obtained in all sub-plots. Field mice and guinea fowl destroyed some of the seedlings, but losses were so slight and general that the few blank holes were not resown.

On 19 November, 1953 the following notes were recorded:—

(1) Weedy fallows: Plants 3 in. high, purple and weak looking.

(2) Bare fallows: Plants 3–4 in. high, some purpling, fairly poor.

(3) Mulched fallows: Plants 6 in. high, all green and vigorous.

(4) *Dolichos* cover: Plants 6 in. high, all green and vigorous.

On 16 December, 1953 all sub-plots received a top dressing of sulphate of ammonia at the rate of 200 lb. per acre and immediately after the plants were ridged up. At this date and again on 30 December, 1953 a random sample of each sub-plot was measured to determine differences in height. See Table 2.

On 15 February, 1954, the weedy fallow, bare fallow and *Dolichos* sub-plots had all evened out in growth and differences could not be detected. The plants in the dry-mulched sub-plots appeared more robust than in the other treatments. It was observed that plants in the two shell-mulched sub-plots were more prone to lodging than in the other treatments, due no doubt to the looseness of the top soil in which the shell had been mixed at ploughing, and to the heavier weight of cobs.

Except in the shell-mulched sub-plots many green and mature maize stalks were cut off at ground level by termites.

*Harvest*

At 23 March, 1954, as all stalks had completely dried out, the cobs were reaped by hand and weighed after sun-drying. For several years the percentage of grain weight to cob weight of ' Sahara ' maize at Vuvuland has been fairly constant at 80% so this figure was employed in computing grain weights. See Table 3.

Statistical analysis of the results showed that the dry-mulched fallow very significantly outyielded the other treatments, which did not differ significantly from each other.

## Discussion

The above results demonstrate very clearly the benefits to be derived from dry-mulching resting land under the soil and climatic condition obtaining at the Swaziland Irrigation Scheme.

Groundnut shell as a dry mulch in comparison with cut grass or groundnut hay appears to have the following advantages: (*a*) it is free from weed seeds and weeds do not grow on it, (*b*) it does not break down easily, and so is the better insulator of soil moisture, and (*c*) it does not appear to encourage termites, whereas cut grass is invariably attacked by the harvester ant (*Hodotermes* sp.) and groundnut hay by microtermes sp.

In the above experiment the shell was put on by hand to a depth of 8 in. Such a depth had the main disadvantages that because of wheel-slip, efficient ploughing and the incorporation of the shell with the soil was impossible, and resulted in the weak anchorage of the indicator maize crop with a consequent high percentage of lodging caused by high winds. A more recent trial has demonstrated that a depth of 3–4 in. is equally effective in insulating soil moisture without in any way affecting ploughing efficiency or proper incorporation

TABLE 3
COB WEIGHT OF SUB-PLOT IN POUNDS (SUB-PLOT = 0.1 ACRE)

| Treatments | Treatment totals | Treatment means | Yield (lb. per acre) | | % of control |
|---|---|---|---|---|---|
| | | | Cob wt. | Grain wt., 80% | |
| (1) Weedy fallow .. | 1,169 | 233.8 | 2,338 | 1,870 | 100 |
| (2) Bare fallow .. .. | 1,064 | 212.8 | 2,128 | 1,702 | 91 |
| (3) Hay-mulched fallow | 912 | 304.0 | 3,040 | 2,432 | 130 |
| (4) Shell-mulched fallow | 824 | 412.0 | 4,120 | 3,296 | 176 |
| (5) *Dolichos* cover .. | 1,142 | 228.4 | 2,284 | 1,827 | 98 |
| Block totals .. .. | 5,111 | 255.5 | — | — | — |

The hay and shell dry-mulch results are separated in Table 3 for emphasis.

TABLE 4

| *Treatment* | *Area, acres* | *Actual yield, lb.* | *Yield per acre, tons* | *Percentage of unmulched* | *Percentage of large and extra large tubers* |
|---|---|---|---|---|---|
| Shell-mulched | 0.8222 | 13,500 | 8.21 | 136 | 74.7 |
| Unmulched | 2.7378 | 33,038 | 6.03 | 100 | 60.1 |

of the mulch. Such a reduction in the depth of shell mulch would allow 167% more fallow land to be treated in any one year.

It was obvious from the start of this experiment that the application by hand of groundnut shell to large areas of fallow land would not be economical, but it is contended that the shell could be efficiently applied by a muck-spreader or scattered from bags by juvenile labour sitting at the back of an ox-cart or Ferguson tractor. In any case it would appear that the increased yield accruing from shell-mulched fallows, the residual value of the shell to soils, the ease and cheapness of preparing shell-mulched fallow land with lighter implements (thus eliminating the costly plough), the fact that shell-mulched soil remains wet and soft throughout the dry winter period and so can be efficiently prepared for cropping at any time without awaiting the break of the rains, the reduction and possible ultimate elimination of weeding, the protection of the soil from rain pounding and erosion, and last but very important, the complete retention and conservation of the total rainfall, should in the long run more than offset the cost of transport and application of the shell mulch.

Since writing this article subsequent experiments employing groundnut shell as a mulch to growing maize and groundnuts under rain-fed conditions and to irrigated potatoes have again demonstrated the value of this material. For example, a 3-in. shell mulch applied to a high, hard area of soil which, because of termitaria, dried out very quickly after irrigation, considerably increased the yield of potatoes at Tunzini Section, Swaziland Irrigation Scheme, in the 1954 winter. The results are shown in Table 4.

Increased yields of nuts, hay and grain were also obtained from shell-mulching growing groundnuts and maize at rain-fed Vuvuland Section.


## Summary

(1) Some methods of building up and maintaining soil fertility are discussed.

(2) An experiment is described in two phases, comparing the effects of a weedy fallow, a bare fallow, a dry-mulched fallow, and Dolichos-bean cover on the yield of a subsequent maize crop.

(3) Statistical treatment of the results demonstrates the significant superiority of a dry-mulched fallow.

(4) Methods of application and the advantages to be derived from groundnut shell mulching are discussed.

(5) The beneficial effect of shell-mulching growing groundnuts, maize, and potatoes is recorded.



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# III—Ratooning of Rice on the Swaziland Irrigation Scheme


G. SZOKOLAY


ON the low veldt of Swaziland nine months of the year (from August to April) are suitable for rice cultivation. May, June and July are the winter months. There is a so-called 'rainy season' of frequent storms during November, December, January and February, and the average annual rainfall over a period of 37 years is 25.84 in.

The relative humidity and temperature during the nine months' rice-growing period is shown in Table 1.

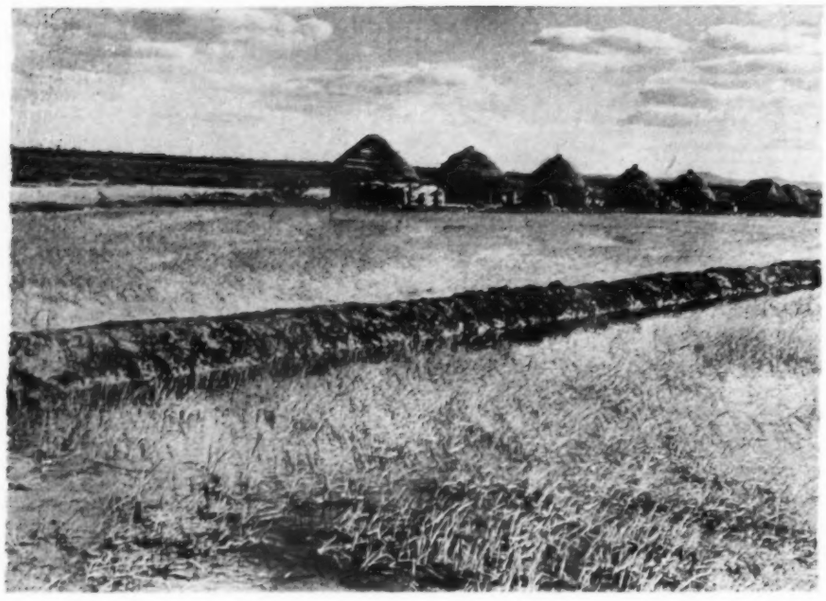
## Construction works

Rice experimental work and a 200-acre pilot scheme in 1951–52 preceded construction in 1952–53 of the Border Gate Extension, terraced, paddy-rice scheme on 2,000 acres. Irrigation water is provided by pumping plants on the Komati River. Earth-moving machinery was used for the building of the distributory canal system and the terraced paddies, and only trimming jobs and structures were done by hand labour.

To avoid unnecessary earth moving, and to allow terracing of the fields without serious disturbance of the top soil, a grid map was surveyed on the field showing the elevations on each 15 sq. yd. Between each terrace there was a vertical interval of 6–9 in. A net acreage percentage of 79–84% was achieved by this system, the rest being drainage, safety strips, canals, roads, paddy bunds, sundry lands and buildings.

Stop dams, sluice boxes, overflows and safety overflows are laid down in the paddy fields. By this mechanised system an average of 20 acres is irrigated night and day by one Swazi worker.

*Irrigating furrow with stop dams and sluice boxes. With the method used in Swaziland one Swazi worker is able to control the irrigation (night and day) of about 20 acres*



*Rice paddies divided by earth bunds. The labourers' huts can be seen in the background*

Land preparation, fertiliser distribution, planting and harvesting are all fully mechanised. For planting, seed drills are used, and for reaping, combine harvesters. All the drivers are locally recruited Africans.

## Ratoon crop

The nine-months' period suitable for the cultivation of rice brought to mind the possibility of growing two crops per year. This could be achieved by planting two crops a year of short vegetative period varieties. But from December onwards in Swaziland the rainy season interferes with mechanised land preparation and planting of a second crop; this job could only be done on small peasant holdings. A ratoon crop appeared to be a possible solution and experiments were started as far back as 1950 with local and other varieties, different fertiliser applications and irrigation methods.

Promising results in the experimental plots were followed by field trials. The various rice varieties showed different ratooning characteristics under different cultivation practices, and a method was first worked out to obtain a ratoon crop immediately following the harvest of the main plant crop. The vegetative period of the ratoon crop was shorter than that of the main crop, owing to its already having an established root system. Table 2 shows the vegetative cycle and yields of some main and ratoon crops grown on trial plots.

To produce a successful and even ratoon crop it is essential to harvest the main-plant crop at the right time, the best time being when the main crop is fully ripe and the stools of the ratoon crop have just begun to grow. In order to do this, with mechanical harvesting, a well-controlled irrigation and drainage system is needed, although on small peasant holdings, where the harvest is done by hand, the difficulties with uncontrolled water might be overcome. The ratoon development begins soon after the main crop is ripe, and in the case of delayed harvesting of the main crop the stools of the growing ratoon crop, which come up between the first crop's straw, will be damaged. A particular disadvantage is if rains should come at the time when the first crop is ripe and ready for harvest, because this will both delay the harvest and cause the ratoon to grow more rapidly.

## Fertilisers

Fertiliser mixtures are needed for the main crop and for the ratoon crop also. Phosphate and potash are broadcast in the form of superphosphate and muriate of potash before the planting of the main crop and are given in quantities calculated to be sufficient for both the main and the ratoon crops. Nitrogen is given in the form of sulphate of ammonia as a topdressing for both the main crop and again for the ratoon crop.

The work undertaken since 1950 on the production of ratoon rice crops has included experiments on planting distances, planting rates, time of planting, water requirements, fertiliser applications with mixtures containing varying quantities of N, P and K, cutting heights and testing of local and imported varieties.

The introduction into commercial paddy farming of a system of ratooning has brought to light difficulties that were not apparent when ratooning was confined to small experimental plots. The yield figures for main crops and ratoons for the three varieties given above refer to main crops which were planted in September–October and harvested in January–February, and to ratoon crops harvested some 2½–3 months later, in April–May. Early planting of the main crop was essential to this system of ratooning, because if planting and subsequent harvesting of the main crop were delayed the growth of the following ratoon crop, even with irrigation, proved to be poor. Planting of the main crop as early as September–October has, however, some disadvantages, chief of which is that it does not permit thorough land preparation and weed control before planting.

TABLE 1

| | *Aug.* | *Sept.* | *Oct.* | *Nov.* | *Dec.* | *Jan.* | *Feb.* | *Mar.* | *Apr.* |
|---|---|---|---|---|---|---|---|---|---|
| Relative humidity (max.) .. .. | 90 | 88 | 90 | 91 | 89 | 88 | 89 | 89 | 86 |
| Relative humidity (min.) .. .. | 10 | 10 | 11 | 34 | 27 | 30 | 25 | 23 | 14 |
| Temperatures (max.), °F. .. .. | 89–64 | 94–52 | 102–61 | 91–68 | 99–70 | 92–75 | 96–72 | 96–68 | 98–63 |
| Temperatures (min.), °F. .. .. | 66–40 | 62–46 | 70–56 | 70–61 | 75–62 | 72–56 | 74–60 | 72–50 | 66–50 |

TABLE 2

| Variety | Cycle of vegetation | | Yields per acre | | | |
|---|---|---|---|---|---|---|
| | | | 1952–53 | | 1953–54 | |
| | Main crop | Ratoon | Main crop, lb. | Ratoon, lb. | Main crop, lb. | Ratoon, lb. |
| Century Patna No. 2 .. .. .. | 3½–4 months | 2½–3 months | 2,682 | 2,694 | 2,542 | 1,480 |
| Swazi No. 1 .. .. .. .. | 5 months | 3 months | 3,040 | 1,320 | 3,300 | 1,300 |
| Swazi No. 2 .. .. .. .. | 4 months | 3 months | 3,424 | 2,899 | 3,108 | 1,646 |

### Alternative system

An alternative system of ratooning has been tried in which an interval of about six months is allowed between harvesting of the main planted crop and the cultivation of the ratoon. Under this system the main crop is planted in November, after thorough land preparation, and is harvested in March. The stubbles are then allowed to stand through the winter without irrigation and no growth is made. When temperatures rise in the spring, usually in September, the stubbles are irrigated and the ratoon crop develops. On a small scale these 'spring ratoons', harvested in January, have given yields not much less than their preceding planted crops. This method does not, of course, secure two crops of paddy in a single year. It may, however, provide in the course of two years two good crops of paddy, involving only one set of land preparation and planting operations; this may reduce costs and, equally important, may lessen the pressure on men and machinery at planting time.

These trials, aimed at securing worthwhile yields from paddy in Swaziland, have given interesting preliminary results, but ratooning of rice cannot yet be said to have been proved on a commercial scale.

### To Authors and Readers

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### Tree Lucerne as Stock Feed

According to Dr. L. C. Snook, Animal Nutrition Officer of the Western Australian Department of Agriculture, many sheep farmers in that State are planting tree lucerne (*Cytisus proliferous*) on a fairly extensive scale to provide their sheep with a protein-rich feed in autumn. Experimental plantings have given a yield equivalent to 2 tons of edible dry matter an acre without irrigation. The dry material contained 22% of protein and 22% of fibre, equal in feeding value to the best lucerne hay. Most cereal hay contains only about 7% of crude protein and about 30% of indigestible fibre.

Tree lucerne is a hardy evergreen legume that can be repeatedly lopped for a high yield of greenstuff, exceeding ordinary lucerne in feeding value. It is grown commonly in many parts of Australia as a hedge plant, but its value as a stock feed seems to have been overlooked. Being of Mediterranean origin, the plant is well suited to most parts of Australia.

The experimental trees grown for sheep feeding were planted at distances of about 8 ft. by 8 ft. and trained to branch near the ground into many stems. If grazing is properly controlled, the trees yield a large bulk of greenstuff in autumn and early winter and are also valuable in providing excellent honey.

The foliage is so palatable that horses and cattle will break off quite large limbs and poultry are so fond of the leaves that they can be fed to them without being chaffed. Trees can be grown in the yards for shade and lopped for feed.

Tree lucerne will grow well on a variety of soils, including deep sands, but, like all legumes, it must be adequately manured with superphosphate. Every year the trees shed a heavy crop of pea-like seeds, which may be raised in boxes or beds in the spring for planting out in the autumn.

### Soil Mechanics Laboratory

A soil mechanics and hydraulics laboratory is being established at Karachi by the Government of Pakistan, with the assistance of the U.S. Government under their economic aid programme. The laboratory is designed to facilitate economic planning in the design of development projects in the field of irrigation. It will provide scientific data for the selection of the engineering problems involved. So far the Government of the U.S.A. have contributed Rs. 624,000 during the fiscal year 1955, and the Government of Pakistan have provided about Rs. 725,000.

## Christmas Acknowledgments

We have received, during the Christmas season, cards and diaries from the following:

R. W. Gunson (Seeds) Ltd., Villiers Engineering Co. Ltd., Sidney-Barton Ltd., Netherlands Dairy Bureau, John Deeley, Birtas, ScotMec Works, Fisons Pest Control Ltd., Marketing Consultants Ltd., May & Baker Ltd., R. C. Liebman, Press and Public Relations Ltd., Yalding Works, International Harvester Co., James A. Hodgson Ltd., Edwards High Vacuum Ltd., Universal Crop Protection Ltd., Willsmore & Tibbenham (Norwich) Ltd., Dorman Sprayer Co. Ltd., Massey-Harris-Ferguson, Shell Petroleum Co. Ltd., Central Agricultural Control, Publimondo, Algot Holmberg, Plant Protection Ltd. and Hatif Oge.

We acknowledge these with many thanks.

# The Bhakra-Nangal Project

S. RAMANATH

*It is considered that India's food production will be substantially increased when the Bhakra-Nangal Project is completed. Moreover, it is estimated that India will save Rs. 600 million on food imports and further foreign exchange will be saved (approx. Rs. 300 million) by the production of 800,000 bales of long-staple ginned cotton as a result of the scheme.*

EVERY year, during the monsoon, over 50% of the water flowing down the Sutlej River in the Punjab goes to waste. The Bhakra-Nangal project was undertaken to conserve and utilise this water for irrigation and power production. The Bhakra Dam, the world's second highest dam when completed, will stand 680 ft. above foundations and store enough water to irrigate 10 million acres of land and generate 400,000 kW. of electricity. It is located about 200 miles from Delhi and nearly 70 miles from Chandigarh, East Punjab's new capital, at a point where the river cuts a narrow gorge through the last range of the Himalayas.

About 40 miles upstream from Rupar (a town in East Punjab) the Sutlej is harnessed to serve the teeming millions in the Punjab. The Prime Minister of India on 8 July, 1954, opened the gates of the world's longest canal—the Nangal Hydel Channel—and released life-giving water through Bhakra-Nangal's irrigation network, which interlaces one of the most arid regions of India.

Among the schemes of economic development undertaken by the Government of India in recent years, Bhakra-Nangal is by far the biggest and the most ambitious multi-purpose project of its kind being executed anywhere in the world today. The project, which was conceived in 1908 by Sir Louis Dane, the then Governor of Punjab, was started only in 1949 and the work commenced in earnest in 1950.

### Statistics

The gigantic nature of the task involved in the construction of this mighty project can be imagined from the following figures: Concrete and masonry work will be in the neighbourhood of 500 million cu. yd. Rock, conglomerate and gravel required will be 400 million cu. ft.; excavation of earth 3,500 million cu. ft.; cement more than 1½ million tons; steel and steel bars 117,000 tons; timber 1,042,000 cu. ft.; coal 250,000 tons; petrol 7½ million gal.; lubricating oil 1,800,000 gal; grease 1½ million lb. In addition, this mammoth enterprise will use large quantities of machinery, tools and other special equipment.

### Finance

Estimated to cost about Rs. 152 crores, this project is being financed by the Governments of Punjab, P.E.P.S.U. and Rajasthan on loans obtained from the Government of India. The annual return, including betterment fee, will be 3% on the capital outlay on irrigation 10 years after the completion of the project. The relief to the people and the State Exchequer in the form of alleviation of famine conditions in the area of the Bhakra main canal system can be gauged from the fact that the State Government had to spend from 1938 to 1940 Rs. 3 crores on this account.

The main features of the project are:

1. The Bhakra Dam.
2. The Nangal Dam.
3. The Nangal Hydel channel.
4. The Ganguwal power house.
5. The Kotla power house.
6. The irrigation system.
7. The power-transmission system.

### The Bhakra Dam

The Bhakra Dam is India's pioneer concrete high-dam project. The length of the top will be 1,700 ft. At bed level it will have an effective width of 625 ft. To allow the unwanted flood waters to flow over the dam a central spillway, 260 ft. long, controlled by four steel gates will be installed. To release water for purposes of irrigation from the Bhakra reservoir 10 outlets will be provided in each of the two tiers at calculated heights. Between these outlets 106,000 cu. ft./sec. can be let out for irrigating fields downstream and in combination with the spillway; altogether 290,000 cu. ft. of water can be let out of the reservoir at a given instant. The gorge in which the Bhakra Dam is being constructed has steep sides. The foundations and abutments were found to be of hard, sound, massive sandstone rock and interspersed with blocks of buff-coloured, shattered and sheared claystone, at some places necessitating careful treatment. Such portions will have to be stripped from the sides of the gorge to a sound ledge and all fissures and cracks closed by grouting under pressure. The 550-ft. railway tunnel for conveying concrete has also been taken in hand and 32,000 cu. yd. of rock have been removed from the downstream portal portion. The problem of concrete placement is made difficult by the absence of proper roads on the sides of the gorge; consequently all of the concrete has to be placed by machinery. A 5-mile belt conveyor is being constructed for the transportation of the aggregate to the site. A big batching and mixing plant is being erected to manufacture an average of 110,000 cu. ft. of concrete every working day. The concrete from the batching and mixing plant will be transported on diesel-propelled cars having a capacity of four buckets of 4 cu. yd. each. Double cantilever and Whirley cranes will lower them to the spot where the concrete is to be poured. There will be five trestles for the purpose of placing the concrete, involving 5,000 tons of steel. More than Rs. 20 crores have been spent so far on the Bhakra Dam and its appurtenant works. To keep the mixing bins continually fed, 45 cars carrying 9,000 tons of cement a day will be moved over a

distance of eight miles of mountainous terrain—24 hours a day for four years.

It will be possible to install 10 generating units, each with a capacity of 90,000 kW., at the Bhakra Dam for generating hydroelectric power. In the initial stages only one such unit may be installed.

The reservoir created by the Bhakra Dam will have a total storage capacity of 7.4 million acre-ft. of water. However, all this water will not be available for use because of silt deposits in the water. Wastage caused by such deposits has been estimated at 1.7 million acre-ft. of water. Thus the irrigation system has been planned for only 5.7 million acre-ft. This reservoir will create the Govind Sugar Lake, which will be about 50 miles long. The width of the lake just upstream of the dam will be about three miles.

In order to divert the Sutlej River from the dam site to keep it clear of water so that work on the dam may begin, two giant tunnels on either side of the dam have been constructed. Lined with a layer of cement concrete over 3 ft. thick, the tunnels will withstand the onslaught of the river's swift current for the next four or five years. Considered to be a stupendous engineering feat, they are each about half a mile long and 50 ft. in diameter. They have a capacity of 250,000 cusecs, to pass the maximum flood discharge of the river. Their construction involved 555,000 cu. yd. of excavation and 214,000 cu. yd. of concreting. On completion of the dam, the need for the tunnels will not exist. The process of diversion should have commenced by the end of 1955, when a coffer dam upstream of the site should have been built to bifurcate and pack the river into the tunnels. Another coffer dam will be raised downstream to prevent the water from receding to the site of operations.

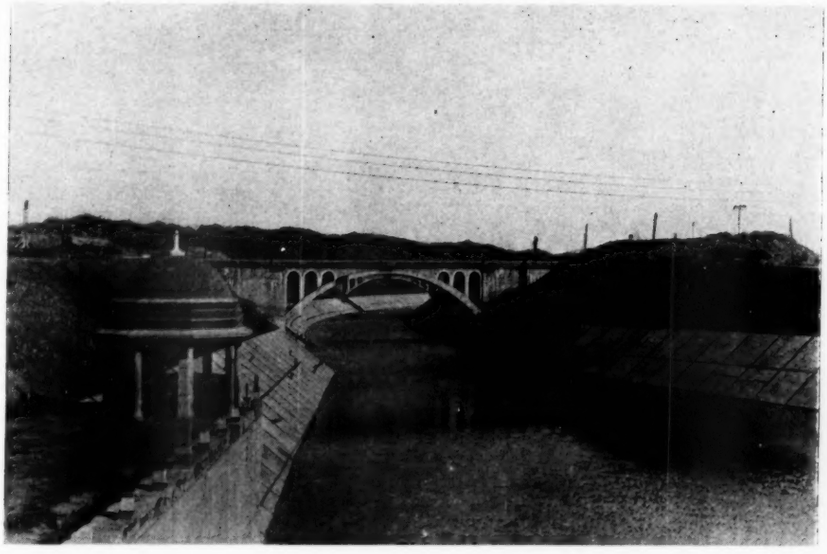
## The Nangal Dam

The Nangal Dam can be divided into three main parts:

(i) The barrage, consisting of 26 bays each of 30-ft. span.

(ii) A head regulator for the Nangal Hydel channel, consisting of eight bays each of 24-ft. span.

(iii) A shingle excluder in front of the head regulator covering two bays of the dam.



*A view of the Nangal hydel channel with water flowing through it*

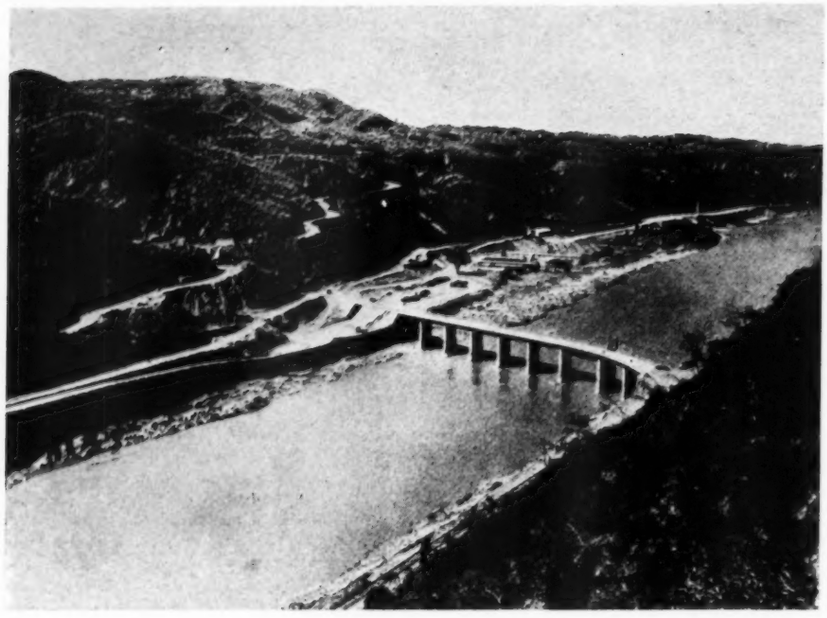
*The barrage* (*Nangal Dam*).—The Nangal Dam is a low concrete dam located eight miles downstream of the Bhakra Gorge, where the River Sutlej pierces the last range of the Shivaliks, popularly known as the Naina Devi range, to enter the plains. This dam is primarily intended to feed the Nangal Hydel channel, on which three hydroelectric power stations of the maximum generating capacity of 164,000 kW. will be constructed. The dam is designed as a concrete barrage across the river, with a clear waterway of 780 ft., provided by constructing 26 bays of 30 ft. each, separated by 7-ft.-wide piers. The overall length of the dam is 955 ft., height 91 ft., and length of impervious floor is 338 ft. The waterway has been designed to pass a flood of 350,000 cusecs with an afflux of about 3 ft. The hub of the entire irrigation network is the Nangal Dam, which is expected to serve the dual purpose of acting as a balancing reservoir for the Bhakra Dam and of diverting water into the Hydel channel, Begun in 1946, it was finished in 1951. but could not be put into operation immediately owing to the absence of gates, which were installed only in 1954.

## Head regulator

Nangal Hydel channel takes off immediately above the dam through the head regulator built in the left flank. This regulator consists of eight bays of 24 ft., each separated by 6-ft.-wide piers. It has been designed in such a manner as to obtain the maximum draw down for the storage reservoir upstream of the dam. Nangal Canal is essentially a hydel channel and it is most undesirable that any shingle should pass. A double-decked shingle excluder has, therefore, been provided in bays Nos. 1 and 2, to prevent the entry of shingle into the canal. The shingle excluder consists of six tunnels facing the flow of water into the head regulator.

## Nangal Hydel Canal

The Nangal Hydel Canal is the channel which will feed the Bhakra Main Line Canal and its distributory system and runs parallel to the River Sutlej. It will also be utilised for the generation of hydroelectric power. The total length of the canal is about 40 miles up to Rupar, from where the Bhakra Main Line Canal takes off at its tail. This is the biggest canal ever constructed in the Punjab. The bed of the canal is 92.6 ft. wide and is trapezoidal in shape. The whole length of the canal has been lined with either cement-concrete slabs or with tiles. This lining will greatly reduce absorption and will make available maximum discharge for generating electricity and for irrigation. It will also eliminate the danger of waterlogging. The canal has been provided with underground drainage in the tracts where the subsoil is



*The 650-ft.-long rail and road bridge at Bhakra*

high, so as to drain out seepage water at the bottom. The natural slope of the area through which the canal passes is steeper than that for which the canal is designed and this fact has facilitated the construction of power houses at Ganguwal and Kotla. These power houses form the first phase of the Bhakra - Nangal project, but preliminary work has already started on the second phase, which includes the installation of further units at Bhakra.

### Power houses

The inauguration of the Ganguwal power house during January 1955 marks the fulfilment of the hopes cherished by the people of Punjab since partition. As a result of this power house various projects of development will gather momentum and indigenous industry will receive the necessary fillip, particularly in the States of P.E.P.S.U. and Rajasthan. The power generated in these power houses will be transmitted to the various load centres in Punjab, P.E.P.S.U., Rajasthan, Himachal, Pradesh and Delhi over a vast network of transmission lines totalling about 1,800 miles. An important feature of the transmission network is the use of 220,000 V. for the transmission of power on the Nangal–Delhi line, this being the highest voltage so far used in India. These lines will feed more than 70 grid sub-stations from which electricity will flow to the consumers both in urban and rural areas. The transmission lines have been so designed and the location of grid sub-stations so selected that practically no place in the State will be more than 30 miles from the nearest grid sub-station.

Kotla power house is located 18 miles off the Nangal Hydel channel. A spillway channel has been constructed at Kotla power house at a cost of Rs. 31 lacs in order to by-pass water which is over and above the requirements of the power houses.

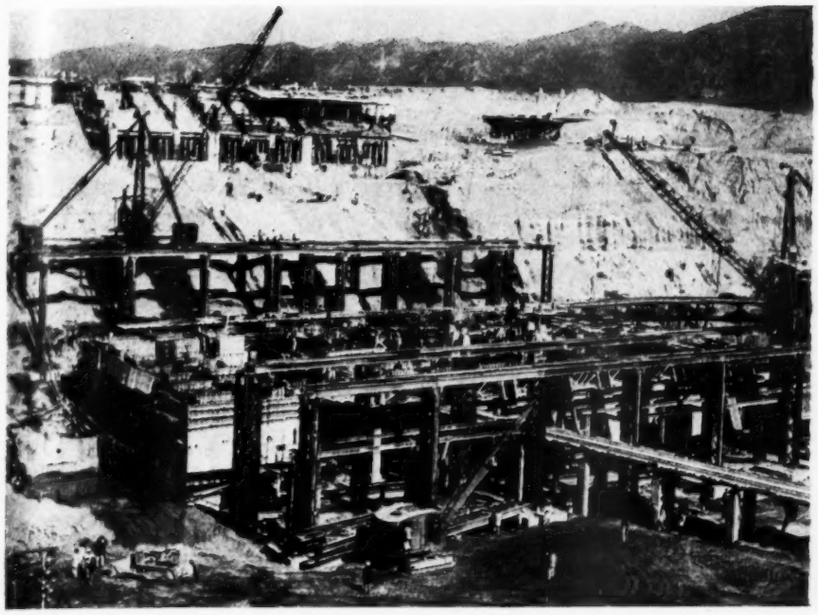
Both Ganguwal and Kotla will generate 48,000 kW. of electricity each. There is a provision in these power houses for further increasing their capacity. It was expected that Kotla power house would be in operation by the end of 1955. Ganguwal and Kotla power houses and the first unit at Bhakra are estimated to cost the Government of India over Rs. 51 crores and the total power generation will be over 400,000 kW.

### The irrigation system

The future of the Nangal Canal is thus rightly a source of great wealth and prosperity which must flow from the lands it will irrigate and factories it will energise. These benefits are going to be realised almost from its very inception, although they will be multiplied many times after the completion of the Bhakra Dam. The irrigation of the arid areas during the khariff season and the supply of firm power in the region of 400,000 kW. will transform a large number of towns in the Punjab, Rajasthan, Delhi and P.E.P.S.U. The Nangal Hydel channel, the Bhakra Main Line and the Bhakra Main Branch form the longest single-unit lined-canal system in the world.

The Bhakra Canal system will make a network of major and minor channels running to a total length of 2,790 miles. The main feeder canal of this system—the Bhakra Main Line—will take off from the tail of the Nangal Hydel Canal and will be 108 miles long, lined with impervious tile masonry containing a sandwiched layer of mortar throughout its length. From this will branch out the main arteries of the system, to lead 12,560 cu. ft./sec. of much needed water to the parched land on both sides. The original schedule aimed at the completion of Bhakra Main Line and its branches in 1955, and the Narwana Branch and the Bist Doab canal systems in 1956, but this work has been accomplished much ahead of schedule, thereby making a saving of Rs. 3.5 crores. The significance of the work becomes still greater when it is realised that most of the canals had to be dug through sub-mountainous hilly tracts and had to cross torrents and drainages and required great engineering skill. The system, when fully developed, will irrigate a total area of about 10 million acres. This includes 5,883,705 acres to be covered by the main irrigation network of the Bhakra canals and 3,724,064 acres of additional area under the Sirhind canals. The length of the main canals and branches is 677 miles and that of distributaries is 3,958 miles. The number of cross-drainage works in the entire system is 48 and the number of road bridges 250. Railway bridges (17) have also been constructed. The total earthwork involved was 239 million cu. yd. The income likely to accrue to the people, even with the non-perennial irrigation, will be in crores of rupees, which will be further enhanced when perennial irrigation is available.

The produce of the area covered by these canals would be worth about Rs. 132 crores. Statistics of additional agricultural production are food-grains 11.3 lakh tons per annum, sugar-cane 5 lakh tons, pulses and oilseeds 1 lakh



*Foundations being laid for the Ganguwal power-house and head regulator*

tons, dry and green fodder 15 lakh tons and cotton 8 lakh bales. This will also mean an additional Rs. 3.2 crores to the revenue of the State, which will in turn be spent on other development works.

The criterion of success of the Bhakra-Nangal project, like that of any other enterprise undertaken by the Government of India, is the return it brings on the capital investment. The expenditure involved is considerable and the total estimated cost of the project will be Rs. 1,514 million. Out of this amount Rs. 593 million are for the Bhakra Dam and power plant, Rs. 282 million for the Nangal Dam, the Nangal Hydel Canal and the Nangal power plant, Rs. 365 million for the Bhakra Canal system, Rs. 101 million for the Sirhind Canal extension, the Rupar headworks and the Bist Doab Canal, and Rs. 172 million for the power-transmission system.

As a result of this project food production will increase substantially and it is estimated that India can save foreign currency worth Rs. 600 million spent on food imports. It is hoped that about 800,000 bales of long-staple ginned cotton will be produced every year and thereby a saving of another Rs. 300 million can be effected in foreign exchange. Thus the overall saving in foreign exchange will amount to Rs. 900 million annually in addition to the other benefits gained, including 10 million acres of land for cultivation and 400,000 kW. of power.

The power available from the project will be utilised for electrification of 128 towns and installation of 800 electric tube-wells in the rural areas. Extension of supply to rural areas is one of the special features of the project. Heavy and cottage industries are bound to flourish as a result of the plentiful supply of electricity, providing work to lakhs of unemployed persons.

## Agricultural Crops in Hawaii—I

*Continued from page* 66

The fibreboard is used in building construction (ceilings and walls).

Research and experimentation by the H.S.P.A. is progressing toward the eventual commercial manufacture of other paper products from bagasse. It has also been determined that suitable livestock feeds may be processed from bagasse. There are definite commercial possibilities in these two fields as practically all of the paper products and feeding-stuffs used in Hawaii are imported.

Most of the molasses produced is shipped to the mainland U.S. for alcohol manufacture and incorporation into animal feeds.

*Part II of this article will appear in the March issue of* WORLD CROPS

## Agricultural Investments in Hungary

The Hungarian State will invest £66 million in agriculture during 1956, Mr. Andor Berei, chairman of the National Planning Committee, told Parliament.

The greater part will go to strengthening the socialist sector—the State and co-operative farms and the machine stations. The bread-grain-sowing area is to be extended by 210,000 acres, maize is to be kept at its present relatively high level, and rough fodder is to be increased by 224,000 acres. Cattle stock is to be raised from 880,000 to 915,000 head, sheep by about 200,000 head. Pig stock, which ' soared out of proportion in 1955 ', is to be slightly reduced, as well as horse stock.

Industry will supply £20 million worth of machinery, including 304 reaper-threshers and 3,759 tractors. This will make possible a 12% increase in mechanical cultivation.

## Teak Forests in East Pakistan

Teak forests in East Pakistan at the time of partition covered an area of five to six hundred acres. Large-scale plantations of teak now extend over 6,000 acres.

The Food and Agriculture Organisation of the United Nations has, in its recent session held in Rome, set up a Commission to survey the teak forests of the world. The East Bengal teak forests contain trees which are considered amongst the highest in the world. Trees there, in some cases, attain a height of 150 ft. The average height of Burma teak trees extends to 120 ft. The teak forests of Java are known to possess the biggest trees, which grow up to a height of 160 ft. in some cases. According to the opinion of experts, East Bengal teak is considered one of the best.

Teak forests take nearly 80 years to grow to their full height, but some countries have, by artificial methods of manuring and irrigation, reduced the period to 45 years. This teak is, however, not so stout as when grown under normal conditions.

The stems of trees in East Pakistan teak forests generally become fluted. Research is being conducted to eliminate this defect.

# CONTROL OF THE NUNNE MOTH IN THE FOREST OF EBERSBERG

## Report on the use of DDT fog

K. THIELMANN

*The recent heavy Nunne moth infestation of the Ebersberg Forest confirms that the occurrence of this pest is largely due to the climatic and physical features peculiar to that area. Normal biological control is not sufficient and it is shown that the use of chemical insecticides is necessary if control is to be maintained. Successful results have been obtained with DDT fog applied with Todd Insecticidal Fog Applicators. This article is published with the permission of the author and The Lister-Todd Engineering Corporation Ltd.*

THE Ebersberg Forest near Munich is a classical example of the destruction wrought by the Nunne moth (*Lymantria monarcha* or *Liparis monarcha*). In 1890–91 this pest had already destroyed over 12,000 acres of the woodland. The work of reafforestation, hindered by the most adverse weather conditions, was not completed until 1930; by then the forest, consisting mainly of fir trees, was between 35 and 60 years old.

### Forest survey

This same area was again attacked by the Nunne moth, first in 1952 and again in 1953, and on such an increased scale that the whole forest was in serious danger of complete defoliation.

To determine as accurately as possible the degree of infestation the Institute for Applied Zoology in Munich was asked to make a survey of the whole forest. This survey was carried out and an infestation map was produced to show the average number of female larvae per tree. It revealed an infestation of the whole area, ranging from an average of one female larva per tree at the limits of the infestation to an average of 10 larvae per tree in the areas of densest infestation. The larvae were very healthy and the moths which hatched out each laid a large number of eggs, on average 140. Since only a thousand caterpillars are sufficient to defoliate a tree, complete destruction could be foreseen in the main breeding areas and at least serious damage to the other areas.

It should be remembered that birds and other insects, normally the natural enemies of moths and caterpillars, are of little importance in the control of this particular pest, partly because of the extremely high reproduction rate of the Nunne moth and partly because the poisonous hair of the caterpillars makes it a most unappetising prey.

Any estimation of the degree of Nunne moth infestation is extremely difficult, for not only are the eggs and even the larvae hidden under the bark of the trees, but the hatching moths, if the weather is at all windy, may fly away from their breeding grounds. It was decided, therefore, to make a count only of the larvae infestation.

The survey showed natural but important variations of the number of larvae, ranging from 300 to 3,000 per tree; infestation tended to increase in the sheltered areas and to decrease in the more open and more windy regions.

Once the survey had indicated the limits of the infested areas, the next step was to decide upon the means and methods of control.

### Control methods

The survey had made it apparent that infestation was increasing a hundredfold; this meant that there were some 2,400 million caterpillars to be destroyed. Modern forestry just cannot afford the loss of woodland on such a scale and since in this instance biological methods of control were of no value other means of control were necessary.

Of all modern insecticides, DDT has proved both in the field and in laboratory trials to be the most effective against the caterpillars. Moreover, DDT has relatively little harmful effect upon other forest insects. DDT was therefore the obvious choice.

The next question was the method of application. The trees in the Ebersberg Forest have numerous and very low branches, often reaching right to the ground, and there are no trees with less than 10 layers of branches.

Aircraft spraying would have gained only a limited success, for the lower branches would have been unaffected. Similarly with power dusting; the first strong wind or rain would have blown or washed the dust to the ground, where any good it may have done would be undone by its effect upon woodland insects.

It was decided, therefore, to use an insecticidal fog. Experience had already shown that a thermal aerosol has the greatest power of penetration through the thick foliage of a forest. Two T.I.F.A.s (Todd Insecticidal Fog Applicators) were therefore used. T.I.F.A. machines had already rendered invaluable service during the Weiden Forest operation in 1950.

### *The Development of the Operation*

It was necessary to have an organisation that would ensure not only that control measures were carried out as quickly as possible, but also would be able to adapt itself quickly to changing weather conditions and other obstacles. A forest headquarters was therefore established. First the area of infestation was noted on maps to show both the degree and the extent of the damage; then the affected areas were divided into zones of attack.

Two attacking teams were formed—each under the direction of an experienced young administration officer, each of whom had a T.I.F.A. and

trailer, together with a driver and servicing staff. Insecticide and petrol were stocked at headquarters. There also were lodged, mainly in caravans, all those engaged in the operation. Every morning and evening after the local weather forecast had been given the day's plan would be discussed.

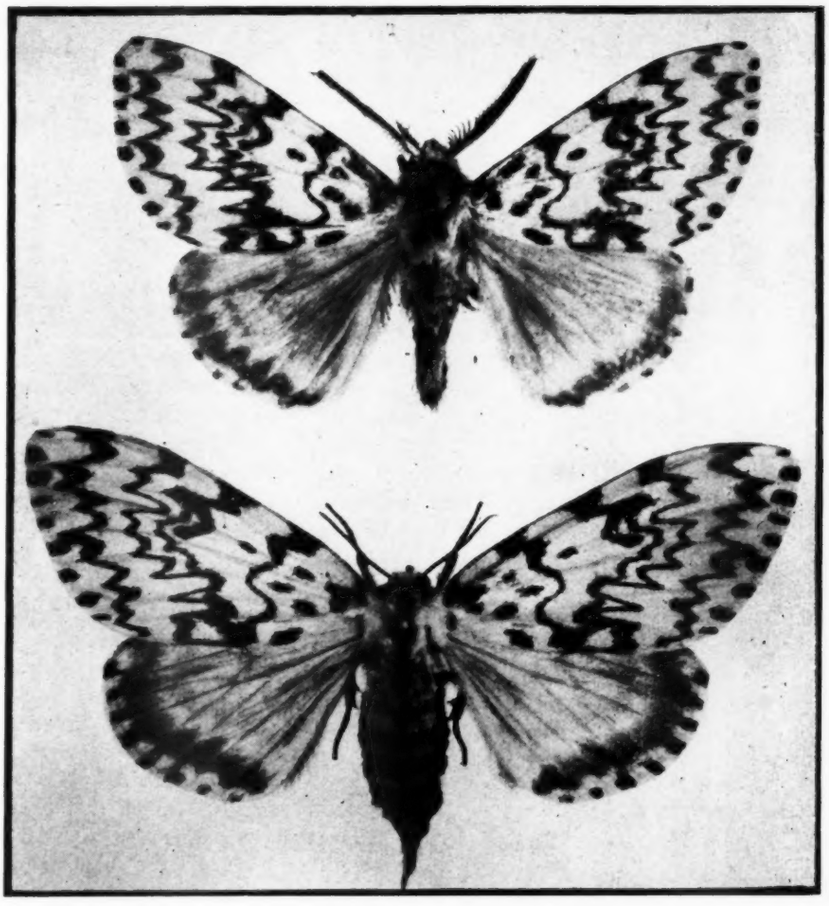
In spite of the hardships, setbacks and difficulties, the organisation was most successful.

The weather conditions during the first part of the summer of 1954 could not have been worse. The normal high-pressure system seldom built up; instead, for almost the whole time, the forest was on the edge of a low-pressure system coming in from the Mediterranean, with the result that the winds varied from day to day—at times very gusty, at times non-existent. There was also a great deal of fog and much rain. Moreover, the peculiar physical features of the forest itself—the numerous glades and openings, the uneven rides and the wide, open areas—did not make the work any easier. Naturally, when it was raining heavily, fogging had to be abandoned. Again, the forest itself, with its dense plantations and large branches reaching almost to the ground, did not allow easy penetration by the fog. As a result the operation had to be renewed and amended almost daily. Often where penetration had not been achieved fogging had to be repeated.

In spite of all difficulties and interruptions, it was possible to complete the first part of the control campaign between 28 May and 15 June, 1954.

## Use of DDT

Based on the experience of the work in Weiden in 1950, where a 10% DDT solution proved sufficient for the treatment of a mixed plantation of firs and pines, the same mixture was at first used at Ebersberg. This, however, was only efficient in the more sparsely populated areas. A much stronger solution of 20–25% was necessary in areas where the trees were dense and where they were more heavily branched—where the needle surface area would naturally be much greater. Moreover, the low-hanging branches had a strong filtering effect on the fog, making deep penetration almost impossible. In such areas the penetration was reduced to 50–90 yd., whereas in the less dense areas it was 200 yd. and more.



Lymantria monarcha *Linn.* (*Above: the male; below: the female*)
[Photo: By courtesy of the Natural History Museum, London]

## Costs

It is extremely difficult to give figures of cost with any degree of accuracy (any figures of cost per acre would be misleading), for the important factor is not the actual area of the forest itself, but the total surface area of the top surfaces, *i.e.* of the needles and of the branches. Naturally, where there was a greater concentration of insecticide and where there was less penetration operational costs were increased. Comparison with other treatments cannot really be made, since so much depends upon the type of insecticide used.

The actual cost in the Ebersberg Forest was approximately 32s. per acre—naturally it was higher in those areas where repeated fogging was necessary.

The experience at Ebersberg has reconfirmed the view that the first instars are considerably easier to kill than the later instars. In one instance there was proof that six hours after fogging, when caterpillars of the second instar were already dead, those of the third instar were still showing a strong reaction and those of the fourth were almost normal, although all had been equally affected. Owing to the extremely bad weather, it was, unfortunately, not possible to complete the control programme at all quickly and more than a fortnight had elapsed before the last areas were treated. There the caterpillars had reached the much stronger stage and the percentage of the kill as a result was less than that at the beginning of the campaign. Wherever the kill had been insufficient either because of bad weather or because of poor penetration these areas were refogged.

As a result of the operation it has been possible to preserve an area of nearly 4,000 acres which had been threatened by complete or near complete defoliation by a pest which numbered from 500 to 10,000 caterpillars per tree. This would have meant the end of that fir-tree plantation. The complete destruction of the Nunne

moth over the whole area of some 12,000 acres was not envisaged. For biological reasons extreme control measures of this kind can only be applied when the very existence of a forest is threatened. Therefore, the less heavily infested areas in Ebersberg were not treated; but there, despite increasing parasites, a new generation of the Nunne moth is developing and a new control action will soon be needed. It does seem that, although the parasites would be sufficient to make any effective control of this generation of Nunne moth, it would only succeed *after* defoliation: the forest would be destroyed before the pest could be controlled. Some protective control, therefore, is necessary to all those areas where infestation is over and above a certain degree. The areas of greatest reproduction for 1955 have moved to the outer limits of the infested area. A new control, therefore, for this infestation will be necessary as well as planning a new operation for the campaign as a whole. It is hoped then that the whole area will be completely freed from Nunne moth.

### Summary

The heavy Nunne moth infestation of the Ebersberg Forest just described, so similar to the infestation of 1890–92, is again proof that the appearance of this pest in such concentrated masses is largely due to climatic and other physical features peculiar to that area. The danger increases with the increase of the surface area. Biological control is not sufficient and the use of chemical insecticides is necessary if control is to be maintained.

Of all the insecticides, DDT is by far the most efficient against the pest.

Both dusting and spraying are insufficient in dense plantations which are thickly branched; at the best they can only be partly effective.

By far the best chance for success is by fogging and then only by machines producing a true fog, *i.e.* a fog with a particle size of less than 30 $\mu$. Fogs with a very mixed particle size, such as those produced by mechanical means, possess no powers of penetration and do not hang sufficiently or rise sufficiently to deposit the insecticide on the crowns of the trees.

Spraying with aircraft is, of course, independent of terrain and of forest rides, but there is insufficient downward penetration and therefore it does not gain complete control in the denser plantations.

Since it is apparent that the German Forestry Commission will have to deal for some years to come with unmixed plantations which, quite naturally, are more prone to attack by a mass infestation, it is their intention to study closely any new development in chemical control, and not only to try to improve on the methods of control, but also to try to lower costs.

## *FAO Measures Against Locusts*

Increased international activity in many parts of the world will be a feature of the fight against locust plagues during the next two years. Delegates approved the Organisation's activities in this field and strongly endorsed the Director-General's policy for 1956 and 1957.

In a comprehensive resolution, the conference authorised the Director-General to pursue his present policy of co-ordinating international measures against locusts, not only in the Arabian Peninsula where most of FAO's work has so far been done, but in every part of the world where such international action is required. As in previous years, it will be the desert locust that attracts most of FAO's attention, and in 1956 the Organisation expects to spend about $100,000 on control of this pest under the Technical Assistance Programme; it will be used chiefly in co-ordinating and supporting the efforts of the invaded countries. This sum, of course, is small compared with what desert locust invasions may cost individual countries, as was pointed out by the Moroccan member of the French conference delegation. Last year's invasion, he said, had cost his country around 5½ million dollars, and already a further invasion is in progress.

For the 1956 campaign against the desert locust in the Arabian Peninsula, the number of control teams and vehicles, and amounts of equipment and insecticides used are expected to to be even greater than in previous years, and the cost of the campaign is already estimated at over $1½ million. The greater part of this will be provided, as formerly, by the various governments contributing to the campaign,* either in cash, supplies, or by providing control teams.

* Bahrain, Egypt, France, India, Iran, Iraq, Jordan, Kuwait, Pakistan, Qatar, Saudi Arabia, Sudan, Syria, Turkey, United Kingdom, Yemen, Arab League.

## *Fertilisers for Antarctic Expedition*

Messrs. Fisons Limited are co-operating with the trans-Antarctic Expedition by providing special fertilisers for growing salad vegetables for consumption by the staff at the Polar Base during the 2½ years of the Expedition.

A small hydroponicum will be set up at the Base. Vermiculite will be used as aggregate; a glass or plastic hut will provide shelter and light—with MAV lamps during the night—and melted snow will be used for watering.

## *Technical News*

The contents of *Dairy Engineering* for February will include articles on ' Cleaning and Sterilising Aluminium Dairy Equipment ' by J. C. Bailey, B.SC., F.I.M.; ' Crate-Stacking Equipment ' by F. Proctor, M.A.; and ' Electric Dairy Water Heating and Steam Sterilising Equipment—I ' by H. J. Urwin, A.M.I.E.E.

The February issue of *Food Manufacture* contains articles on ' Dairy Products ' by A. W. Marsden, M.SC., D.I.C., A.R.I.C.S., F.R.I.C.; ' Vinegar Manufacture ' by H. P. Mollenhauer; and ' Microscopical Technique for the Food Analyst—I ' by S. M. Charlett.

*Muck Shifter* for February includes articles on ' Excavating Under Water ' by A. G. Arend; ' Muck Shifting in the Soviet Union ' by W. J. Cass; and ' Outline of the Scheme for the Dam at Assuan, Egypt '.

Among the articles appearing in the February issue of *Chemical & Process Engineering* is ' Hydrazine as an Oxygen Scavenger ' by Dr. S. R. M. Ellis and C. Moreland; and ' Chemical Industry Trends in Europe ' by A. Survey.

Articles included in the February issue of *Paint Manufacture* are ' Stearates for the Paint Industry—II ' by M. L. Stumpf; and ' The Formulation of Industrial Paint Removers ' by W. F. Daggett.

*Electric fencing is a means of controlling many wild beasts in Tanganyika, particularly the elephant. It serves as a method of preserving crops, such as maize, millet, sorghum and groundnuts*

# CONTROL OF GAME AND VERMIN ANIMALS

H. F. LAMPREY

(*Biologist, The Game Department, Kondoa Irangi, Tanganyika*)

*The following report was prepared by Mr. Lamprey for the benefit of local farmers, but the method used, perhaps with variations to meet other requirements, can be adapted for use in many areas other than Tanganyika. It is reprinted with the permission of Wolseley Engineering Ltd., Electric Avenue, Witton, Birmingham 6, England.*

THE following animals have been successfully controlled in experiments with electric fencing: Elephant, rhino, buffalo, zebra, wildebeest, bushbuck, Grant's gazelle, eland, bush pig, wart-hog, baboon, hyena and jackal. Giraffe are difficult to control by electric fencing, but a more complicated and expensive technique has proved fairly successful.

The use of electric fencing in very dry conditions presents a problem that can be overcome with some additional expense.

## Apparatus

The following apparatus has been used successfully and is recommended:

Fencer: ' Wolseley ' bell-type.

Wire: 12-gauge, galvanised mild steel (100 lb. = 11,100 yd.).

Plastic insulators: butterfly type.

Metal clips (optional) for insulators.

Nails (2-in.) for fixing insulators to poles.

Battery: car-type accumulator or Varley dry accumulator.

Test light for testing current in wire.

On a single wire fence there will be about 150 insulators per mile.

The machine runs off a 6-V. supply. A 6-V. car battery may be used or half a 12-V. car battery. The advantage of using car batteries is that they can be recharged in a vehicle. If a charging plant is available the small Varley dry accumulator is suitable. It is cheap and handy, and is sold by the agents for Wolseley fencers.

The posts for the fence should be hard wood if possible and should be charred or creosoted to prevent rot and termite damage. The distance apart of the posts will depend on the flatness of the country. An average of about 12–15 yd. should be aimed at. Posts should be placed so that the wire follows the undulations of the ground rather than being carried low over a bump and high over a hollow.

The earth pin for the fence should be a piece of steel, iron or copper sunk to a depth of about 3 ft. in damp soil. If possible the earth should lie in the wet soil beside a furrow or pond. If this is not possible a bucket of water should be thrown over the earth every day, except in wet weather.

## Characteristics of apparatus

One fencer will electrify 20 miles of wire in damp weather and about 7–10 miles in fairly dry weather, depending on the nature of the soil. In very dry conditions, two kinds of soil become non-conducting, *i.e.* red soil and sandy soil. Where the fence has to cross

*This photograph was taken in the Kilimanjaro area of Tanganyika; giraffe require a higher electrified wire than other wild game*

patches of these soils an 'earth return' wire must be used. This will be described below. Although a single fencer will operate many miles of wire, it is advantageous to use several fencers for the following reason. Should a large animal knock the wire down and earth it, the whole length of wire will be dead or will have a reduced power. Thus in a long fence it is best to have two or more independent sections so that the earthing of one section will not affect another. However, where it is expected that few animals will come into contact with the wire during any one night, a single machine is sufficient.

A fencer will run for at least three weeks on a single battery charge, provided that the wire has not been seriously earthed for a long period. If the machine is only switched on at night, the charge will last five weeks or longer.

## Wire heights for various animals

Bush pig, wart-hog, hyena and baboon: 15 in. Rhino, buffalo, zebra, wildebeest, Grant's gazelle (wire at this height is satisfactory for elephant): 30 in. Elephant (also satisfactory for giraffe): 5–6 ft. Giraffe: 6–8 ft.

*Special measures for 'difficult' species*

*Baboon.*—The single wire at a height of 15 in. will not stop baboons by itself. In most cases it will be seen that a troop of baboons has a favourite point of entry into a shamba, and follows a well-worn path of approach. At the point or points of approach there should be three wires over a distance of about 100 yd. The three wires should be at heights of 12 in., 24 in. and 36–40 in. The top wire need not be electrified but then it should be well earthed, so that a baboon will be discouraged from jumping and will get a shock if it stands on the bottom wires and touches the top wire. When the leaders have received a shock they will probably avoid the wire completely. However, it has been found that baboon troops are very persistent and will try to get in for at least a week after the wire has gone up. After two weeks it is usual for them to avoid the fence altogether.

*Eland and impala.* — These two species are good jumpers and it is necessary to use a wire at a height of 5 ft. to discourage jumping. The high wire is best electrified in wet weather because eland usually touch it with their noses and get a powerful sting. In dry weather, or where impala only are present, the top wire is best earthed. This ensures that the eland will get a shock by touching the high wire and the 30-in. wire, which will be electrified. For these two species it is helpful to make the top wire more noticeable by hanging small branches on it. These branches must not touch the lower wire if the top wire is earthed. It also helps if the poles are whitewashed (see under giraffe below).

*Bushbuck.*—The single wire at 15 in. discourages bushbuck where the main enemy is pig. However, a more effective height for bushbuck is 20–24 in.

*Elephant.*—In wet weather the single wire at 30 in. has proved to be about 90% effective. To improve this performance it is necessary to raise the wire to 5 or 6 ft. or, where other animals are to be excluded as well, to use a second electrified wire at 5 or 6 ft. Dry weather fencing for elephant will be described below.

*Giraffe.*—This species is the most difficult of all to control. The first requirement is an electrified wire at a height of 6–8 ft. or even 10 ft. if possible. The wire should be barbed for the best results. A second wire, electrified in wet weather, and earthed in dry weather, should be mounted at about 5 ft. It is an advantage to whitewash the poles so that the fence is visible at night. Wherever possible this precaution should be taken against the larger animals, who tend to blunder into the wire without seeing it at night.

## Non-conducting soil

A well-earthed wire should be stapled to the posts at a height of about 20 in. wherever the fence crosses non-conducting soil such as sand and red earth. This wire should be connected to an earth pin sunk in a damp spot if possible or in the nearest conducting soil. The earth pin should be watered. If the earthed wire can be connected directly to the earth lead of the fencer, it will be the more effective. Where a high-level wire such as that for elephant, eland and the 5-ft. wire for giraffe is to be earthed it can be connected directly to the lower 'earth return' wire if care is taken to prevent it touching the electrified wire. Where no bottom earth wire is used the top wire can be earthed by a connection, anywhere along its length, to an earth pin.

For elephant an adequate dry-weather fence consists of two wires as follows:

(1) An electrified wire at 30–36 in.

(2) An earthed wire at 5 ft.

However, where the fence is being used also to exclude rhino, buffalo, and other large game, satisfactory

results will be obtained by using the following arrangement:

(1) An electrified wire at 32 in.

(2) An earthed wire at 15–20 in.

Lastly, in dry weather, a fence to exclude all the larger species will consist of the following wires:

(1) An earthed wire at 5 ft.

(2) An electrified wire at 32 in.

(3) An earthed wire at 15–20 in.

### Erection

A reasonably straight trace should be cut and cleared of all vegetation. Trees that can be utilised for mounting the wire should be left standing, but their tops should be lopped above a height of 5 ft. if they sway in the wind, as this causes the wire to be pulled away. A trace 5 ft. wide is sufficient.

The poles should be placed towards the inner (protected) side of the trace to allow easy access and to leave space for walking. The placing of the poles should be done with a view to keeping the wire at a constant height. Where the ground is very flat the poles can be as much as 18 yd. apart.

### 'End-mounting'

Assuming that the electrified wire will be erected first, nail on the insulators making sure that each insulator is accurately placed on the outside of the poles. Uncoil the wire and lay it along the ground beside the poles. After making a correct 'end-mounting' (follow the makers' instructions for this) connect the wire to the insulators and pull tight. The pulling can be done by two men and a tensioner need not be used. When the wire is mounted it should be carefully inspected to see that it does not touch the poles at any point.

When joining lengths of wire, the ends should be twisted together over a length of about 12 in. to ensure a good electrical contact and a strong joint.

The earthed wire or wires should be stapled to the poles at the correct height.

Put the fencer in an accessible place, preferably where its earth pin can be sunk in damp soil. The machine and its battery should be given a small shelter.

*Crops of standing corn are often ravaged and destroyed by herds of zebra. Electric fencing is one method of keeping them in control*

[Photos : Public Relations Department, Tanganyika]

### Warnings

As with cattle, game and vermin animals have to be educated to the wire. Some time may elapse before every animal that normally visits the wire has had its shock. During this period the wire may be knocked down or broken. It should be repaired as soon as possible. The education period has most often been found to be about two or three weeks.

The fence will need regular inspection. This applies especially during the education period. Africans need careful instruction on maintaining the fence.

No vegetation must be allowed to grow up to touch the electrified wire. During the rains, a few wet blades of grass can earth the current completely. The makers' instructions must be followed.

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### *National Institute of Agricultural Botany*

The National Institute of Agricultural Botany have recently issued revised editions of two of their well-known series of Farmers Leaflets. No. 1, 'Choice of Seed', summarises the main points to consider when buying seed, either for its suitability for the particular purpose in view, or for its quality as seed. There is nothing new in this leaflet, but it is a valuable restatement of points which are so very important and yet easily overlooked. All farmers and horticulturists should read it.

The other leaflet, No. 5, 'Strains of Sugar Beet', gives the details behind those asterisks on the British Sugar Corporation's Seed List, indicating the strains 'Recommended by the N.I.A.B.' The leaflet includes the usual table and descriptive paragraphs giving the characteristics of each recommended strain, and points out that the difference between the highest and lowest yield of sugar is 6% which, at 1955 prices, represents approximately 85s. an acre on a 12-ton crop.

These leaflets can be obtained free of charge from The Secretary, N.I.A.B., Huntingdon Road, Cambridge.

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### *R.A.S.E.*

A decision to hold the 110th Royal Show at Bristol in 1958 was taken by the Council of the Royal Agricultural Society of England meeting in London recently.

This was determined when an invitation from the Lord Mayor of Bristol, Alderman H. Crook, on behalf of the citizens of Bristol, was received and formally accepted by the R.A.S.E. Council. The Show will be held from 1 to 4 July.

# Late Report from Smithfield

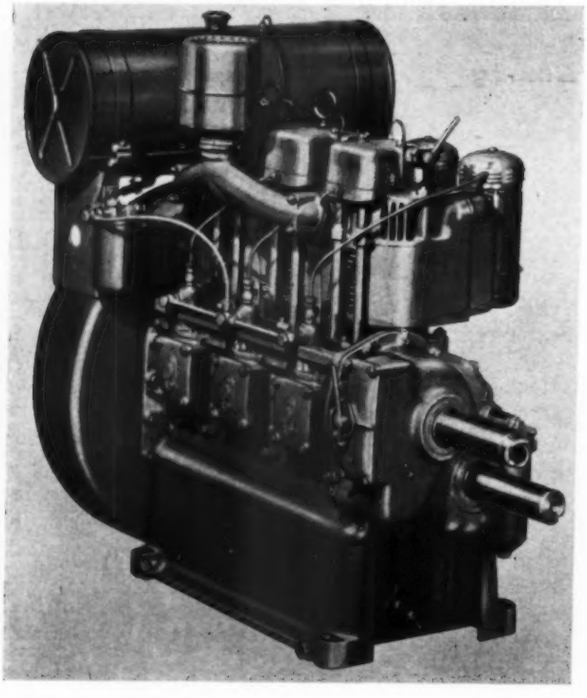
Details of some machines exhibited at the 1955 Smithfield Show have been reported since the original review was published in the January issue of WORLD CROPS.

A new 20/33-b.h.p. three-cylinder engine was shown by **Armstrong Siddeley Motors Ltd.,** Parkside, Coventry. It follows the well-known and well-proved lines of the Armstrong Siddeley single- and twin-cylinder, air-cooled diesel engines. Many of the parts are interchangeable, making for economy and ease of servicing. The power of the new engine ranges from 20 b.h.p. at 1,000 r.p.m. to 33 b.h.p. at 1,800 r.p.m. The drive may be taken from either end of the crankshaft or from a specially strengthened camshaft, which protrudes from the front cover, to give a drive at half engine speed.

**Catchpole Engineering Co. Ltd.,** 19 Hatter Street, Bury St. Edmunds, Suffolk, exhibited the ' Cadet ' top-saving unit. It is on the same principle as the top saver and can be fitted to all ' Cadet ' sugar-beet harvesters. The crown and top of the beet is pierced by a spiked disk and taken on to an elevator, where it is arranged to windrow in heaps parallel to the machine three rows of tops into one.

A swamp model tractor is available from **County Commercial Cars Ltd.,** Fleet, Hants. These are eminently suitable for work on marshes, bogs and swamps. One model is fitted with 30-in. steel tread plates, which give a ground pressure of 2.25 lb. per sq. in. They are fitted with full-length undershields.

The 'Penetrator' mistblower, models II and III, were displayed with the ' Unimist ' nozzle system by **Drake & Fletcher Ltd.,** Maidstone, Kent. The ' Unimist ' is virtually unchokeable and gives a complete range of outputs at all volumes without any adjustment to the nozzle components. The standard aperture of almost $\frac{1}{8}$ in. is retained for all purposes. The output can, however, be varied from maximum down to about one-twentieth by the adjustment of the lever on the relief valve. Thus the same nozzle can be used for high-, medium- and low-volume applications, and the spray emitted in all cases being perfectly balanced and uniform for the particular rate of application required. For close work, such as pyramid fruit, cordons, ground crops and soft fruit etc., the nozzle can be used for high-volume applications as an ordinary high-pressure nozzle without air assistance, but where air assistance is available the carry is improved, and for medium- and low-volume applications, where the angle of spray widens, air assistance is essential.



*Armstrong Siddeley three-cylinder, air-cooled, diesel engine. Bore 4.25 in., stroke 4.25 in., capacity 180.9 cu. in., compression ratio 15:1, b.h.p. 20, 24, 28 and 33 at 1,000, 1,200, 1,400 and 1,800 respectively; four-stroke cycle; o.-h.v.; weight 970 lb. approx.*

**Farm Machinery & Accessories Ltd.,** Holne Cross, Ashburton, Devon, exhibited the ' Viking ' high-capacity combine, self-propelled model ST67. The threshing drum is of large diameter and great flywheel mass. It has six ribbed beater bars, rigidly mounted. The drum is statically and dynamically balanced on a modern machine. It weighs 280 lb.

The concave has eight steel beater bars. An indicator shows accurately the clearance between the concave and the drum.

A large range of irrigation equipment was shown by **Farrow & Sons Ltd.,** Spalding. It included rain guns, couplings and pipelines.

The Hart motorised knapsack sprayer and duster (**Hart Agricultural Engineering Co. Ltd.,** Grosvenor Street, Birmingham 16) created a lot of interest. They claim that spray mist or dust penetrates all types of foliage to a range of 15 ft. or more. The air stream oscillates the leaves, ensuring good coverage on top and undersides. The specifications are: height, 1 ft. 10 in.; depth, 1 ft. 3 in.; width, 1 ft. 6 in.; weight, 32.5 lb.; power unit, 49-c.c. silenced petrol engine.

The 6-ft., p.t.-o., heavy-duty, rotary grass cutter (**Hayters Ltd.,** Spellbrook, Bishop's Stortford, Herts.) has an easy and positive height adjustment from 1 in. up to 6 in. The machines are of robust construction and are suitable for rapid topping of pastures, keeping down thistles, cutting rushes etc.

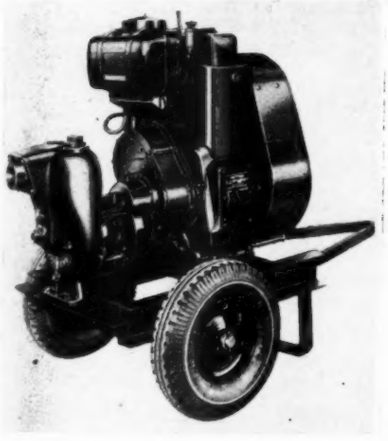
**H. Leverton & Co. Ltd.,** Spalding, exhibited a rear-mounted peacutter and swather, which includes a more flexible cutter bar suspension incorporating channel-section skids with leaf springs. The main frame is of pressed steel; there is hydraulic, vertical control of the reel and all ball-races are sealed and self-lubricated.

A new universal vaporising oil burner unit has been developed by **Joseph Lucas Ltd.,** Great King Street, Birmingham 16, for application to farm needs such as crop drying, where a constant heat is required and for the rapid heating of water. It is simple in design, safe in operation, easy to maintain and reliable. Being

economical in fuel consumption, it can be left to function for long periods with no attention other than that of ensuring that sufficient fuel is available in the tank. This type of burner is ideally suited for other purposes, such as steam raising, water and space heating, as well as grass or grain drying, either direct or with a heat exchanger, and it incorporates several additional refinements. These include a captive torch igniter, a readily adjustable float control, a sturdy mounting panel through which projects an extended entry tube and a pressure balance tapping between the float and burner chambers.

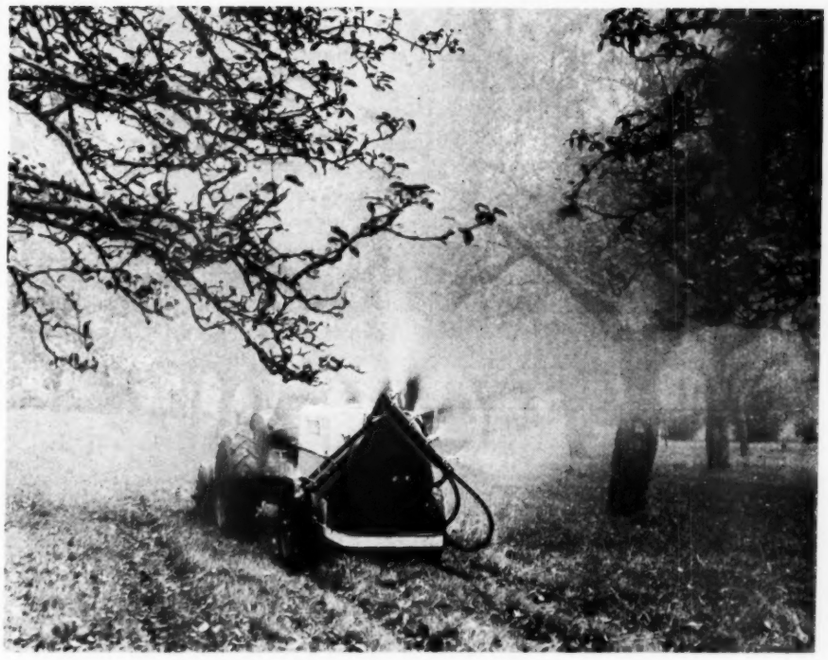
The first commercial dusting machine to employ the principles of electrostatics was exhibited by **Metallurgical Chemists Ltd.,** 24 Old Broad Street, London, E.C.2.

Dust particles are positively charged electrostatically on passing through the discharge nozzle. The charged dust cloud induces an equal and opposite charge on plant surfaces (the image force). The individual charged particles are thus directly deposited on to plant foliage, overcoming all counter-forces normally encountered, such as



*Sigmund diesel-driven, automatic, self-priming pumping set on two-pneumatic-wheel trolley for towing by tractor*

the thermal barrier layer and the forces of gravity and speed. These particles follow lines of electrostatic force similar to a magnetic field induced by the image charge and are consequently deposited in equal quantities on both surfaces of leaves, irrespective of the position of the leaf on the plant. Furthermore, as the particles have each identical positive charges, they repel each other in the same degree and are therefore uniformly distributed all over the plant surfaces without any agglomerations. Being positively charged, the particles are held on to the leaf surface, which has an inherent negative charge.



*Drake & Fletcher's ' Penetrator III ' with ' Unimist ' nozzle and wide-arc-fan outlets for hops etc.*

**Rotary Hoes Ltd.,** West Horndon, Essex, have designed the ' E '-type three-point linkage Howard ' Rotavator '. The widths of cut are 50 and 60 in. The depth of work is adjustable to 8 in. This model has been designed to fit any tractor with category II three-point linkage, which includes most American and Continental tractors. No structural alterations are necessary to the tractor. This model attaches to the two lower link-arms of the tractor linkage and to the top line, the drive being taken from the tractor p.t.-o. by means of a special wide-angle universal joint. Attaching and detaching take only a short time and no special skill is required.

A new Russell product, the RKL universal elevator [**Russell's (Kirbymoorside) Ltd.,** Kirbymoorside, York] for handling bales, sacks, root crops and general merchandise, was on display. It combines a rigid steel frame and well-braced conveyor. Easy and positive height adjustments can be made by means of a simple worm-driven winch.

**Sigmund Pumps Ltd.,** Team Valley, Gateshead 11, showed new pumping and irrigation equipment for the farmer and grower. Recently introduced into the firm's production range, the ' G ' series of automatic self-priming pumps offer advantages for the farm, nursery and market garden. The ' G ' pump primes quickly and automatically and requires no foot-valve. Available in sizes from $1\frac{1}{2}$- to 8-in. branch diameter, the small units are petrol-engine-driven; the larger units are powered by diesel engines.

*The ' Swipe ', a general-purpose slashing machine manufactured by Wolseley Engineering Ltd.*

The ' Welger ' high-density pick-up baler AP10 was displayed by **Western Machinery & Equipment Co. Ltd.,** 57d Great Western Docks, Plymouth, Devon. This pick-up baler is available as an engine-driven or p.t.-o. model. Its design is simple and it is very manoeuvrable on difficult land.

The ' Swipe ' is a general-purpose slashing machine manufactured by **Wolseley Engineering Ltd.,** Electric Avenue, Witton, Birmingham 6. In addition to pulverising potato haulms, it can be used for thistles, bracken, brambles, mustard, ragwort, kale stalks etc. It consists of an upright shaft mounted in ball bearings and is driven by a V-belt from the tractor pulley. On the bottom of the shaft are fitted three chains, which swing out under their own weight when the shaft is driven round at high speed. A 4-ft. swath is cut and the cutter can be offset to work outside the tractor wheels when trimming the bottom of hedgerows etc.

## *Trench Digging*

Some interesting performance figures and costings for the ' Dinkum Digger ' have been provided by the manufacturers. This machine is creating a lot of interest in the Middle East and the interest is heightened by the company's policy of exporting it on a sale-or-return basis.

In treating the question of cost, it should first be remembered that the greater the depth of trench the greater is the economy of machine digging. Most contracts, where the nature of the strata is not known, contain what is known as a rock clause. This means that when rock is encountered and mechanical breakers have to be brought in, or when concrete has to be removed, extra charges are made. For the purpose of these notes all such contingencies are ignored.

When costing for hand labour a normal charge per cubic yard would be 7s. 9d. to 9s., according to the district, but this would apply only to a depth of 5 ft. After 5 ft. additional charges are made. The reason for this, which may not at first be apparent, is that a man cannot throw the spoil back from the trench from this depth and another man must handle the spoil again. As it is thrown up from greater depths another man may also have to be employed on staging, thus throwing the spoil up in two lifts to the top. The following figures are offered as a rough guide. As will be readily seen, there are many conditions which can cause variations in costings.

### Performance figures

The average output of the ' Dinkum Digger ' with a trained operator is approximately as follows:

| | *cu. yd. per hour* |
|---|---|
| Heavy clay .. .. | 8 to 10 |
| Average soil conditions.. | 15 to 17 |
| Sand or loose soil .. | 18 to 24 |

Many people are putting up better performance figures than this, but it is better to give a reasonable figure such as an average man can achieve rather than figures put up by experts.

### Costings

Based on three-year write off, payment of drivers, fuel, banksmen and replacements.

(1) Digging house foundations 24 in. wide by 2 ft. 9 in. deep and loading the spoil into a lorry (clay soil) 2s. 3d. per cu. yd. with the ' Dinkum Digger ', 8s. od. per cu. yd. by hand labour.

(2) Digging a sewer trench 2 ft. wide and 6 ft. deep 1s. 9d. per cu. yd. with ' Dinkum Digger ', 9s. od. per cu. yd. by hand labour.

These figures were collected from a customer and worked out by his quantity surveyor. When hand digging they based their charges on one man excavating:

¾ cu. yd. per hour in clay.

½ cu. yd. per hour in chalk and flint.

½ cu. yd. per hour in packed gravel.

It will be seen, when working out at a net rate of 3s. 11d. per hour, including stamp and insurance for a navvy, who will excavate ½ cu. yd. per hour, that the machine, which is excavating 10 cu. yd. per hour at a cost of 22s. 6d., has taken the place of 20 men, whose labour would have come to £3 18s. 4d. This figure, of course, ignores the fact that a man would not dig a 2-ft. 9-in. trench and throw his spoil into a lorry in one movement.

The following are some costings that were worked out on a five-year write off and are well within the scope of an average operator as long as he maintains his machine correctly.

| | *cu. yd. per hour* | *s.* | *d.* |
|---|---|---|---|
| Average trenches .. | at 12 | 1 | 0 |
| Deep, wide trenches | ,, 18 | | 8 |
| Loose soil conditions | ,, 24 | | 6 |

### Performance figures

(1) In a medium heavy soil a pit 15 ft. × 10 ft. × 4 ft. deep was excavated in one hour.

(2) In Birmingham area, in average digging conditions, 153 ft. of trench 4 ft. 6 in. deep and 2 ft. wide was dug in two hours (18 cu. yd. per hour).

(3) On the Continent a trench 0.70 m. wide, 1.1 m. deep and 26 m. long was dug in one hour. The ground was a lava deposit known as pumice and would be about the equivalent of tight-packed gravel (20 cu. m. per hour).

These are a few examples taken at random from performance figures that have been sent to Whitlock Bros., and if taken in terms of cu. yd. per hour it will be seen that, in conditions varying from heavy clay to light sandy soil, the ' Dinkum Digger ' replaces from 10 to 20 men.

| | *Per year of 50 weeks* | | | *Per week, 50 p.a.* | | | *Per hour, 40 per week* | |
|---|---|---|---|---|---|---|---|---|
| | £ | s. | d. | £ | s. | d. | s. | d. |
| Initial cost of machine, say £1,500, written off over five years .. .. | 300 | 0 | 0 | 6 | 0 | 0 | 3 | 0 |
| Interest on capital at 5% p.a. .. | 75 | 0 | 0 | 1 | 10 | 0 | | 9 |
| Spares and maintenance on machine .. | 150 | 0 | 0 | 3 | 0 | 0 | 1 | 6 |
| Oil and fuel .. .. .. .. | 100 | 0 | 0 | 2 | 0 | 0 | 1 | 0 |
| Operator.. .. .. .. .. | | — | | | — | | 4 | 0 |
| Overhead .. .. .. .. | | — | | | — | | | 9 |
| | | | | | | Net cost per hour | 11 | 0 |

# NEW PUBLICATIONS

## *Agriculture in Haiti*

By Marc Aurele Holly; Introduction by Pierre G. Sylvain. Pp. 313, illustrated. New York: Vantage Press Inc. 1955. U.S. $3.50.

This is one of a number of works published as a contribution to the sesquicentennial of Haiti's independence. Mr. Holly obtained a British Council scholarship in 1945, which enabled him to spend 18 months at Oxford University, where he specialised in rural economy.

The book is a description of actual agricultural conditions in Haiti studied in the light of the sound principles of agricultural policies. Some proposals and recommendations for the improvement and transformation of the primitive agriculture are made so that efficient production and a higher standard of living might be obtained.

The first chapters are concerned with the scientific aspect of Haitian agriculture; soils and climate are described and discussed in relation to agricultural production. The author then goes on to review the present systems of land tenure in Haiti, pointing out *en route* the advantages and defects. The Haitian peasant, likewise, is described with all his basic good qualities and his main shortcomings. The most important export and food crops grown by the peasants are studied and a summary of the improvements that could be made in the system of cultivation of each of them is provided. A scheme of improvement and State aid for animal husbandry is proposed.

Where the economics of Haitian agriculture are concerned, the author makes an analysis of the status and characteristics of the chief factors in agricultural production, *i.e.* land, labour and capital.

A section of the volume is devoted to agricultural education in Haiti. In a plea for more and better agricultural teaching institutions the author says: ' In this modern world of rapid change, Haitian farmers must be more efficient if Haitian agriculture is to survive. To become so they must be more educated, both generally and professionally, and they must be surrounded by a healthier and more pleasing environment '.

The last chapters of ' Agriculture in Haiti ' deal mainly with the problems of agricultural credit, the marketing system and the duties and responsibilities of the State to agriculture and, reciprocally, the duties of the farmer to the nation as a whole.

The author is to be congratulated on the fruits of his task, for he has exhaustively surveyed the entire field of Haitian agriculture, and this despite inadequate statistics or written source material.

The main problem is certainly a moral and educational one, and all who are interested in Haiti, particularly agronomists, educators, administrative officials and politicians, would do well to study and ponder this book.

E.L.B.

## *So Bold an Aim*

By P. Lamartine Yates. Pp. 174. Three appendixes. 1955. Rome: FAO. $1.50. 7s. 6d.

This book was written by the author at the invitation of FAO's Director-General, Mr. P. V. Cardon. The author himself was a member of the staff of FAO from its formation—first in the Economics Division and later in the Director-General's Office. Since 1951, however, Mr. P. Lamartine Yates has been employed by the U.K. Colonial Development Corporation and from this vantage point he has had an insight, from a different point of view, into many of the problems with which FAO is today concerned

The book was published to celebrate the tenth anniversary of FAO, for it is sub-titled ' Ten Years of International Co-operation Towards Freedom from Want '.

In the beginning the author, in an inimitable style, pungent and assertive, shows how FAO's creation was a logical development in the evolution of the modern world, and this for two reasons: firstly, as a result of the scientific revolution in which man has forged tools out of his technical discoveries, which have allowed him immensely to increase his control over nature and to produce goods as never before. Secondly, Mr. Yates considers the revolution in thinking, which has taken place concurrently with the scientific advance and which stems from the 18th-century European philosophers, to be a contributing factor.

In a logical manner he then describes the problems peculiar to the industries of agriculture and food, leading the reader to an account of the immediate background to the foundation of FAO. The foundation of the I.I.A., its aims and work are discussed thoroughly and a generous amount of praise is given for the results it obtained in the face of great difficulties. And so, too, is the growing interest of many nations in problems of human nutrition both before and during the war described. Statesmen, agriculturists and nutritionists came to realise that something had to be done to remedy the problem of food shortages in the midst of plenty. Thus was FAO born.

What follows is, perhaps, more widely known through reports of meetings and conferences and by the medium of Hambidge's ' The Story of FAO ', but here, too, Mr. Yates provides a new approach to thought on FAO's formative years and its period of ' growing up '. His instinctively alive treatment of the first few years is a brilliant analysis of the time when conflicting ideologies were engendering uncertainty in the ' youngster '.

The account of how this question was resolved, along with the resolution of the problems that beset the world in the shortage/surplus complex, shows an acute perception. The final chapters deal with the actual way in which FAO functions, both as an intelligence service for its member governments and also in the technical-assistance field, and some of the major problems (together with possible solutions) still facing FAO are considered in a thought-provoking manner.

Three appendixes are included and they give a list of FAO's member nations, a selected and annotated list of publications, and a list of training centres.

This is a book quite worthy to be read by those to whom FAO is more than a set of initials and by those who wish to know more about a body whose ideal of, and practice in, international co-operation is benefiting millions of under-privileged people and securing fairer shares between nations.

H. TRAVERS-BROOKE

# REPORTS

**Long Ashton Annual Report, 1954.** 1955. Pp. 207, plates 13. From the Secretary, Agricultural and Horticultural Research Station, Long Ashton, Bristol. 15s. Judging from the marked trend of this report, the study of major nutrients in fruit growth is departing from the Long Ashton programme and attention is now centring upon pomology, pathology and pesticides and, of course, fruit-juice and cider-production problems. Mineral nutrition has become the province of the A.R.C. micro-nutrient unit now also based upon Long Ashton.

The report contains 29 papers, 15 of them on the control of diseases or pests; of these 15, nine are concerned with problems of spraying and two others deal with field-stage aspects of control. Two fairly new pesticides have been studied, the fungicide captan, the mite ovicide, and chlorbenside for red spider control. The use of radio-isotopes as ' tracers ' in pesticide research is being developed, *e.g.* movement of copper from fungicide deposits has been studied.

Pomological research has been substantially concerned with the influences of ' hormone-type ' organic substances, *e.g.* 2,4,5-TP for fruit ripening and naphthalene acetic acid for preventing ' running-off ' with blackcurrants.

It becomes more and more difficult to remember that this research centre began its life during this century, starting with a single shed and a lean-to laboratory. In 1954 there were several investigations of a far from localised nature, such as fungicides for controlling banana leaf spot in Jamaica. Dr. Kearns visited Kenya, Tanganyika and Zanzibar as well as Jamaica. Dr. Hewitt visited Nigeria to advise on oil-palm nutrition. Dr. Woodcock and Dr. Luckwill took up visiting posts at U.S. universities.

As these scattered and brief comments indicate, a report of exceptional diversity, but one that must often make complex reading for non-specialists. The time has perhaps arrived when the Long Ashton report should include summarised reviews of each department's progress in addition to the general introduction.

D.P.H.

## OEEC Publications

We have received three OEEC publications recently. The first deals with ' *Leptinotarsa decemlineata* Say ' (Colorado Beetle) in Europe, 1954.

In this publication European countries are treated singly and information is given on the control measures undertaken to overcome this scourge.

The second publication deals with ' *Aspidiotus perniciosus* Comst.' (San José Scale) in Europe, 1954.

Broadly speaking, no important changes in the incidence of San José scale in Europe were recorded in 1954. Apparently all countries have made efforts to keep the pest under control and effective steps are taken in the interest of the export trade, both by an increasingly severe supervision of nurseries and of agricultural produce intended for export and by the use of proved methods of disinfection. It may be hoped that as a result of the publication of the recent report of the EPPO Working Party on San José scale (Lyons, March 1955) the control of the pest in Europe may be made still more effective.

The third publication is entitled *Development of Seed Production and the Seed Trade in Europe.* $1.00, 350 F. Fr. or 7s. This publication includes technical papers read by guest speakers at an international conference on seed production and the seed trade, which was organised in Stockholm by the Ministry of Agriculture for Sweden. Some of the conclusions and recommendations reached by the participants are included.

## FAO Publications

*Forest Seed Directory*, 1955. $1.00 or 5s. A directory of suppliers of seed of woody species for forest production, erosion control, game and wild-life management, shelterbelts and windbreaks, and for animal fodder.

*Prices of Agricultural Products and Fertilizers*, 1954–55. $0.60 or 4s. 6d. This paper is the fifth of a series of annual studies on the same subject. It has been prepared by the joint ECE/FAO Secretariat of the Agriculture Division of the Economic Commission for Europe.

*World Catalogue of Genetic Stocks of Rice*, Supplement No. 5. This issue of the ' World Catalogue of Genetic Stocks of Rice ' includes contributions from the Gold Coast, India, Malaya, the Philippines and Taiwan (Formosa). The tabulations are in the same form as in previous issues.

Other reports received include *Legislation on Fertilisers in Latin America*, $1.00 or 5s.; *Manual of Supervised Agricultural Credit in Latin America*, $0.50 or 2s. 6d.; *Problems of Food and Agricultural Expansion in the Far East*, $0.75 or 3s. 9d.; and *Food and Agricultural Legislation*, Vol. 4, No. 2, which deals with land tenure and land reform in Argentina, France, Norway and Viet-Nam, subsidies to farmers in Finland, agricultural credit in France and price control in Finland.

**Department of Agriculture, Cyprus,** Annual Report for 1954, Annexure VI

A comprehensive account of the work undertaken under the aegis of the Department of Agriculture in Cyprus. Cereal production remains the backbone of Cyprus's agriculture and the main farming activity on the plains.

**Farm Fires and Their Prevention.** London: Fire Protection Association.

Many farmers seem to invite a heavy fire loss by a disregard of some of the first principles for fire safety on the farm. A large number of farm fires could be prevented by more forethought. As the annual cost of the fire damage suffered by agriculture amounts to several millions of pounds, it is worth considering what steps should be taken to minimise this loss.

Care in the siting of ricks and the layout of farm buildings can play a large part in limiting the damage. Attention must also be paid to the provision of water supplies as ample and as accessible as possible, preferably in consultation with the local fire brigade.

These matters and the many sources of fire danger affecting the farmer are discussed in some detail in the Fire Protection Association's booklet, 'Farm Fires and their Prevention ', which is being distributed on a wide scale. It is hoped that the booklet will be carefully read, for it contains many useful hints. A copy of the booklet will be

supplied free on application to the Secretary, The Fire Protection Association, 15 Queen Street, London, E.C.4.

*Synchytrium endobioticum* (Schilb.) Perc. (Potato Wart Disease in Europe, 1954), European and Mediterranean Plant Protection Organisation. A general appraisement and position of different countries with relation to potato wart disease.

**The Oxy-Acetylene Flame Works for the Farmer,** Union Carbide and Carbon Corporation, New York. Farmers interested in the most economical methods of making, repairing and modernising farm equipment can obtain a free booklet that describes 80 typical farm-maintenance jobs done with the oxy-acetylene welding and cutting blowpipe.

**Roczniki Nauk Rolniczych** (Polish Agricultural Annual), 1955, Series A, No. 71. This publication, received recently, includes articles dealing with ' The Effect of Granulated Superphosphate on Yields of Oats ', ' Further Studies on the Resistance of Wheat to Drought During the Period of Germination and Initial Growth ' and an interesting article on the ' Plant Breeding and Acclimatisation Institute '.

**Report on the Cocoa Industry in the French Ivory Coast,** by D. H. Urquhart, B.SC.(AGRIC.), Cadbury Brothers Ltd., Bournville, 1955. A well illustrated and useful report on the cocoa industry on the Ivory Coast under French administration.

A similar publication by the same author is entitled ' Report on the Cocoa Industry in Sierra Leone '.

**Apple Grading and Packing,** Bulletin No. 84, 1955, Ministry of Agriculture, Fisheries and Food, London: H.M.S.O. 4s. 6d. This handbook is useful for all concerned in an exceptionally competitive market; that is the apple market in England, in which English apples have to compete with the finest foreign brand, well packed and attractively presented. The Bulletin is well illustrated with line drawings and 16 pages of photographs; it describes modern packaging practice and the proper methods of wrapping fruit for market. In addition, the grading of apples is discussed in detail and much useful information is given about buildings, equipment, organisation and marketing methods.

**Publications of the National University of Cuyo.** A number of Extension Bulletins have been published dealing with several aspects of wine making. Some titles include ' Clarification of Wines ', ' Influence of the Quality of Gelatine on Clarification ', ' Comparative Study of Champagne Yeasts ' and ' Second Contribution on the Study of the Biology of Flora of Wines in Mendoza '.

**West African Cacao Research Institute,** Technical Bulletins Nos. 1 and 2. The first is by D. J. Taylor and is a summary of the results of capsid research in the Gold Coast (2s. 6d.), and the second, by J. Nicol and D. J. Taylor, deals with capsids and capsid control in the Belgian Congo, with special reference to Lukolela Plantations (1s.).

**The Sugar Beet and its Manuring,** The International Potash Institute, Berne, 1955. Sugar-beet and the study of its nutrient requirements is the subject of this report.

**Studies on the Sigatoka Disease of Bananas and its Fungus Pathogen,** by Lucas Calpouzos, Atkins Garden and Research Laboratory, Cienfuegos, Cuba. The author (Federal Experiment Station, Mayaguez, Puerto Rico) has come to the conclusion that it is possible to plan for the first time a spray-control programme, which would be based on periods of field infections rather than on the appearance of the spot symptoms as is now done. The further studies needed before such a spray programme can be established are discussed:

**The Communities Project Approach to Economic Development,** Noumea, New Caledonia, SPC. 2s.

**Weather and the Land,** Bulletin No. 165 of the Ministry of Agriculture, Fisheries and Food, 1955, London: H.M.S.O. 3s. This Bulletin explains the terms used in radio forecasts and the weather signs of the sky. By marrying these two together it shows how a farmer should interpret a general forecast and apply it in his own locality.

## *Correspondence*

TO THE EDITOR

DEAR SIR,

May I submit the following observations after 20 years' planting in Bihar, India.

As virgin land is cleared for cultivation the soil population is gradually destroyed because (1) their natural food supply is taken away and (2) the ' pan ' starts ' horizontal ' irrigation, causing flooding and bad aeration. Natural, and every form of, irrigation must be vertical. The remaining soil population adjusts itself to the conditions prevailing, with produce steadily decreasing.

The next phase is chemical fertilisers with poison sprays and vast irrigation schemes. Neither sets right the defects given above. Fertilisers may be costly imported food for plants, but the soil populations will produce the plant food free if they are looked after. Sufficient evidence has been given that plants grown organically are not pest-ridden. It seems apparent now that poison sprays for pests go with fertilisers.

The ' pan ' that is formed is just as effective as any city area of streets and buildings in causing flooding after excessive rainfall. A vast scheme for dams and barrages for a city is nonsense, as it is for irrigating an area horizontally.

There is now an apparent phase of greater crop production until the cost of imported fertilisers, sprays and irrigation ruin the farmer.

Every resource of a country should be set to restore the soil population and restore all irrigation to vertical working. Waste vegetable matter and subsoiling incur no vast expenditure and finally give a heavier yield of healthy food for man and beast, without the crushing cost of imported material.

Yours faithfully,
H. ABBOTT

3 Harrington Square,
London, N.W.1.
16 *November*, 1955.

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### *Frost Protection for Citrus*

The *Australian Journal of Agricultural Research*, 1955, **6**, 903, contains an article entitled ' Trials of a Wind Machine for Frost Protection in Citrus ' by H. J. Frith.

# MACHINERY AND EQUIPMENT

### Crop Sprayer

The ' Jumbo ' crop sprayer (manufactured by Farmfitters Ltd., Gerrards Cross, Bucks, England) is designed to provide the farmer or planter with a sprayer at low cost, yet which retains all the features essential for efficient spraying. It is operated by the 'Jumbo' air compressor, which pressurises a 40-gal. tank. The pump itself clips on to the p.t.-o. of any tractor and can be used for many other jobs besides crop spraying—tyre inflation, paint spraying.

The air is bubbled through the liquid, ensuring efficient agitation. A relief valve holds the pressure at 30 lb. per sq. in.; three-stage filtration is provided. The 15-ft. boom folds in behind the tractor and has a spring-loaded breakaway mechanism in case obstacles are met during operation. Spraying rates range from 10 to 36 gal. per acre, according to the type of jet fitted and tractor speed. Special attention has been paid to making the sprayer pack compact to keep shipping and inland carriage charges to a minimum.

The boom is made in sections. The pump itself is very compact and in those territories where petrol is dispensed in 40/44-gal. drums fittings can be provided for these drums. This saves the cost of freight on the one bulky component—the tank—and enables the overseas planter and farmer to buy a crop sprayer at a low price.

### Lighting Plant

H. J. Stockton & Co. Ltd., 8 Draper's Gardens, Throgmorton Avenue, London, E.C.2, have announced that they can now offer a new 400-W., a.c. lighting plant. It is a low-priced machine, powered by a four-stroke, industrial-type engine, integral with a 100/200-cycle flywheel alternator; it requires little attention and provides flicker-free light at small cost.

Named the ' Stokold ', it will not operate most domestic appliances, but the loose-rope-start model is fitted with a p.t.-o. pulley and will drive small pumps, saws or workshop machines. It will also operate some types of crop sprayers.

### Pulling Device for Tractors

A satisfactory coupling between a tractor and trailer should comply with the following requirements:

1. The coupling should have great mobility in the three directions that are perpendicular to each other, to prevent bending of the construction from the different movements of tractor and trailer during operations. If the trailer turns over, the tractor should not be affected. There must, on the other hand, be no play in the coupling that can cause unnecessary wear and lead to reduced control.

2. The coupling should normally be placed low down on the tractor.

3. The coupling should be secured in such a manner that it cannot disengage itself.

4. The coupling should be simple and easy to use, and joining and disengaging must not lead to accidents.

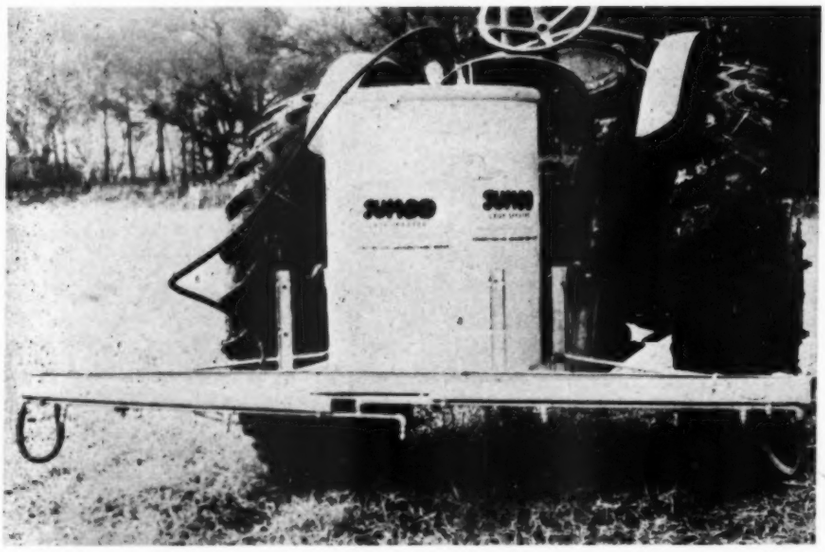
A new device, particularly advantageous when used in connection with trailers with only one axle, was illustrated in *Vern og Velferd* (Norway), 1955, No. 3, p. 48 (in Norwegian). The coupling is fastened to the tractor under and in front of its rear axle. Some of the weight of the trailer's net load is therefore transferred to the front as well as the rear wheels of the tractor.

The front wheels are thus pushed downwards, resulting in a better grip and consequently better control over the steering. The tendency of the tractor to tip upwards is further counteracted by the vertical component of the load.

When this coupling is used with the usual farming equipment the line of direction of the pulling force will be so far down on the tractor that the risk of tipping the tractor upwards is minimal. That the device is fastened low down also lessens the possibility of the tractor turning over sideways.

The device has proved satisfactory during several trial runs.

This information was provided by *E.P.A. Technical Digest* No. 255.



*The ' Jumbo ' crop sprayer. It has a working pressure of 30 lb. per sq. in. and is tested to 66 lb. per sq. in. A pressure gauge, relief valve and suction filter are provided*

### Sherpa IV—Electric Stacker

The ' Sherpa IV ' electric stacker (Salisbury Precision Engineering Ltd., 1 Buckingham Palace Mansions, London, S.W.1) is designed to work efficiently in the confined spaces common to stores, warehouses, corridors, between racks etc., as well as for the on- and off-loading of vehicles.

This electric stacker is useful where rapid movement and ease of handling is the first consideration. Special attention has been given to the negotiation around corners whereby the stacker can be turned within its own radius.

This equipment is fitted with a rotary-driven hydraulic pump, which is

powered by a 12-V. motor, heavy-duty traction battery and gives 60 lifts with full load for each recharge.

Construction is of steel channel adequately stressed to withstand abuse or overload and is stove-enamel-finished. All working parts are totally enclosed.

Easy mobility is provided by two cast-iron, 4-in. wheels at the front and two cast-iron, 6-in.-dia. castors at the rear. Wheels and castors are fitted with roller bearings.

By means of a heavy-duty push-button starter and an infinitely variable release lever the operator has complete and accurate control when raising or lowering loads.

*Specification.* — Capacity, 7 cwt.; maximum height of lift, 6 ft. 9 in.; overall height, 8 ft.; overall width, 2 ft. 8½ in.; overall length, 3 ft.; width between base, 2 ft. 2 in.; minimum turning radius, 2 ft. 6 in.

*The Tarpen electric chain saw felling timber*

## Non-Spill Fence Battery

Fundamental research and prolonged field trials have led to the development of a 6-V. electric-fence battery, combining an ideal electrical performance with robust simplicity of design. Immune to wind and weather, the new battery, the Dagenite 3-LF3, is unspillable and a dimensional equivalent of existing types. Its low-discharge-rate characteristic provides long periods of service between charges.

Among the battery's special features are a tough, one-piece moulded container, large filling orifices to simplify routine maintenance, colour coded, non - interchangeable terminals and fully shrouded live connections to prevent accidental short-circuits.

No loss of acid occurs if the battery is knocked over because the interior of each cell is almost completely filled with Diatomite—a powdery substance that completely absorbs the acid electrolyte. Separators of Porvic—a virtually indestructible microporous plastic material—are also fitted to eliminate the risk of internal short-circuits.

With a capacity of 20 Ah. at the 100-h. rate, the new Dagenite 3-LF3 weighs 15 lb. fully charged and measures 9 $\frac{5}{16}$ in. long × 6 $\frac{1}{16}$ in. high × 3 $\frac{5}{8}$ in. wide. It is available, charged ready for service, through the Dagenite Service Agency Organisation of Holsun Batteries Ltd.

*The new Dagenite electric-fence battery*

## Electric Chain Saw

An electrically-driven hand chain saw was introduced on the market recently by Tarpen Engineering Co. Ltd. It is capable of cutting down trees or through logs and wood up to 7 ft. in diameter. Operating power is derived either direct from the electric mains (when a transformer is advised) or from a portable generator. It was designed originally as an attachment to an electric tiller, but is now marketed as an independent saw.

*The ' Track-Master ' diesel crawler tractor. It has a Perkins 48-b.h.p. diesel engine and is shown hauling a two-furrow plough*

### Portable Winch

A new product of J. Clubley Armstrong Danarm Ltd., Abford House, Wilton Road, Westminster, London, S.W.1, has been designed to make extra use of the engine power of the Whipper and Fury chain saws and to save time and manpower in agricultural and building spheres.

Easily portable—it can be carried by one man—it supplies on-the-spot power lifting or pulling in places that are inaccessible to tractors, and it has the significant advantage over static lifting gear that it can quickly be taken from place to place. In agriculture it has many applications, such as lifting and loading heavy logs and farm machinery, skidding logs across country to convenient loading points, and stretching fences. In building and construction work it can be used to replace a number of static hoists and is available at any time for immediate use on any part of the site.

With the Fury engine it provides a deadweight lift of over 15 cwt., with the line over a single pulley. With the Whipper engine deadweight lifts of over 9 cwt. can be made.

### The ' Track Marshall '

The new crawler tractor, ' Track-Marshall ', announced by Marshall, Sons & Co. Ltd., Gainsborough, Lincs., England, has a drawbar pull of 12,000 lb. The tracks and running gear are of the same general design as in the well-known Fowler Mark VF.

The Perkins L4 diesel engine, developing 48 b.h.p. at 1,600 r.p.m., provides abundant power with maximum economy, and parts and service are readily available. The engine clutch is a Borg and Beck dry, single-plate-type, 14-in. in diameter.

Six forward speeds from 1.31 m.p.h. to 5.15 m.p.h. and two reverse speeds permit economic operation over a wide range of duties.

The tractor incorporates 12-V. starting equipment with dynamo, starter and batteries of ample capacity (to operate lighting equipment when required). An induction heater and priming pump facilitate starting in cold conditions. Steering is by controlled differential, maintaining positive drive to both tracks when turning. Operation is light.

### Roll-Up Doors

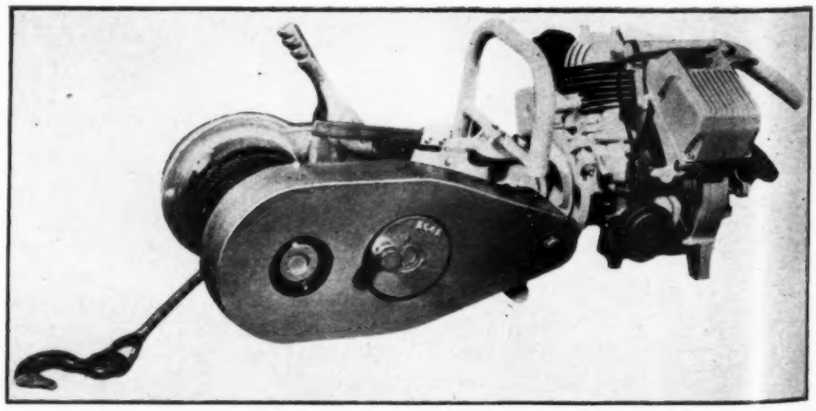
A new version of a roller shutter door has been produced by Golmet Doors Ltd., of Virginia Park, Caerphilly, Glam, England. It incorporates a number of important improvements which are the subject of a patent application, and which greatly simplify its operation and contribute to a considerable reduction in the usual cost for a similar piece of equipment.

Space saving, easy and silent operation, durability, quick installation and a high degree of resistance to corrosion are given as the most noteworthy features of this roll-up door for garages.

The salient feature of the door is that the curtain is made from a single sheet of high-tensile aluminium, suitably corrugated. This curtain, strengthened by a strong aluminium bottom bar, runs in aluminium-extruded guides and is controlled by counter-balancing springs of the best quality.

The door opens upward smoothly and easily and is self-coiling. Slide bolts and hasps, either interior or exterior fitting, are provided for locking the door when in the closed position. The installation is very simply carried out with the eight fixing bolts provided.

The standard size of door produced is suitable for an opening 7 ft. wide and 6 ft. 8 in. high; the door can also be produced in non-standard sizes and the manufacturers will be pleased to submit quotations on request.



*The Danarm ' Falcon ' portable winch. It may be used for lifting and loading heavy logs and farm machinery*

# WORLD CROP REPORTS

## INDIA

### Mesta

The first estimate of mesta in India for the 1955–56 year, released recently, estimates the current acreage of mesta at 125,000 acres, or 13.8% less than the 145,000 acres of the corresponding adjusted estimate for 1954–55. This first estimate does not include the entire area planted to mesta this year, because some late varieties are grown in other states such as Madhya Pradesh, Punjab, West Bengal, Hyderabad and Madhya Bharat.

Complete data are available only for the final estimate. In 1954 the first estimate of 145,000 acres was raised to 502,000 in the second estimate, which was released in March—and further raised to 571,000 acres in the final estimate. However, this current estimate does give an indication of whether to expect larger or smaller acreages of mesta this year.

*Fcr. Crops & Markets*

## MALAYA

The new £200,000 United Cocoa Development Company, which was set up in London last month, is to plant cocoa in the State of Trengganu in the Federation of Malaya and it is believed that initial plantings will be for 500 to 1,000 acres. It is thought that potentially suitable land may total 300,000 acres, most of which will be on the east coast of Malaya.

## NYASALAND

Nyasaland's rice crop in 1955 was twice as big as 1954's and will be more than enough to meet the demands of the whole Federation. Through the new system of African co-operative societies the record quantity of 6,600 tons of paddy (unhusked rice) has been bought from African growers. About 30% of this weight will be lost during dehusking. Agricultural officers attribute the excellent crop to the favourable flooding of the rice fields during the last rainy season.

### Cotton

Indicative of the drive to increase production of cotton in Nyasaland are figures of purchase by the Government Cotton Marketing Board for this season published in Blantyre recently. Despite adverse weather conditions and an increase in pests, 1,400 tons (the equivalent of 2,000 bales) more cotton was purchased by the Board this season than last. This year's purchases by the Board totalled 8,589,564 short tons and £297,316 was paid out to cotton growers. Figures for private purchases in Nyasaland are not yet available, but it is expected that total purchases will prove to be a record. The last highest figures were for the 1934–35 crop.

## YUGOSLAVIA

It is now clear that the 1955 harvest of wheat and maize will have been about equal to that in the record post-war year, 1953. (In that year the wheat harvest was 2.5 million tons and the maize harvest was 4.4 million tons and, while about 100,000 tons of maize could be exported, only about 500,000 tons of wheat had to be imported.) Rainy October weather will, however, have affected somewhat the quality of the maize, as it will also have hampered slightly the sowing of the 1956 winter wheat crop (normally providing nearly all Yugoslavia's production of wheat).

## INTERNATIONAL

### Tea

World production (exclusive of China and the U.S.S.R.) during the first eight months of 1955 was probably slightly higher than during the corresponding period last year, but it is likely that production during the entire year will not vary greatly from the 1954 production of 650,000 metric tons. In British East Africa the trend of higher production continued; in India and Ceylon, where adverse weather and restriction on plucking for quality and other reasons slightly reduced production during the first six months, there was a rise in August. However, there are indications that production will not be allowed to expand significantly above the volume of last year after the heavy pluckings following the ' monsoon flushes '.

### Coffee

African coffee production, increasing rapidly, totalled 6,335,000 bags in 1954–55 and, with an average of lower price levels, is becoming an increasing factor in world trade.

Mexican and Central American coffee production—7,031,000 bags in 1954–55 (preliminary estimate) and increasing to 7,230,000 bags (forecast) in 1955–56—is also a growing competitive factor in world trade.

Should the experience of previous cycles be repeated, production may rise substantially in the next five years, with consumption increasing more slowly—even with prices considerably lower than in 1954 and 1955. It is therefore probable that the world coffee economy may be faced with more competitive conditions in the near future than now exist.

### Rice

World* rice production in 1955–59 (August–July) is forecast at 270,000 million lb. of rough rice, an increase of 3% over the 261,300 million lb. in the preceding year, according to the first estimate of Foreign Agricultural Service. This estimate is 2.5% below the record harvest of 276,900 million lb. in 1953–54.

The production increase is attributed to higher yields per acre in some areas as well as to some extension in acreages. World rice acreage is forecast at 199 million acres, compared with 196 millions in the year before, and with the record of 202 million acres in 1953–54.

Largest crop increases are in Asia, which will harvest 88% of world output. Countries having very good yields are *Japan* and *Thailand*, and crops in *Burma*, *Pakistan* and the *Philippine Republic* exceed those of last year.

Good *European* crops bring the total for that continent above last year's, but slightly less than the record production of 1953. *Africa* has prospects for the largest rice crop in history.

Total production in the Western Hemisphere is forecast at about the same level as last year. A reduction in *North America* will be offset by a larger crop in *South America*, assuming average yields per acre in the Southern Hemisphere.

* Excluding Communist China, North Korea and the Soviet Union.

Good rice crops are anticipated in the principal exporting countries of Asia. Although it is too early to make a final estimate of the November crop in *Thailand*, the trade estimate of an exportable surplus of 1,400,000 metric tons of rice indicates that country is expecting a very good harvest. There was no carry-over from previous crops in Thailand.

*Burma* also planned to export a large volume of rice in 1955. Efforts have been made to increase production. Weather conditions at the outset of the rainy season were favourable and a rise in output is expected.

*Taiwan's* second (November) crop of 1955 is very good. This harvest represents approximately half of total production and about 50% will be harvested in the first crop of 1956 (July).

Floods in *India* this year again have reduced rice yields. Efforts to increase acreage under improved methods apparently resulted in some gain in total area planted. Unusual floods, however, in Uttar Pradesh, Bihar and Orissa, and to a lesser extent in West Bengal, Assam and other areas, resulted in inundation of considerable acreage in rice. Though it is too early to assess the final damage to the crop, which will be harvested mainly in December, indications are that production may not be less than in the preceding year.

*Pakistan's* rice crop, also harvested principally in December, is forecast slightly larger than that of last year.

Rice acreage planted in Japan is estimated officially at 7,617,000 acres, an increase of 1% above that of 1954. Bumper yields were reported during the October harvest. The out-turn of the Japanese crop is not certain at this time, but with information available the crop is placed at a rounded figure of 30,000 million lb. of rough rice (10,940,000 metric tons in terms of brown rice). This compares with the previous record of 29,111 million lb. (10,617,000 tons of brown rice) in 1953. At this estimate, yields per acre are unusually high.

Though drought in the *Philippine Republic* again prevented planting of all the intended acreage in rice, increases in new areas resulted in a small acreage gain above that of the preceding year. So far indications point to a yield per acre about the same as last year. Thus the 1955 crop, which is harvested principally in December, was expected to be slightly larger than a year earlier.

*Ceylon's* second (September) 1955 rice crop was above average and plans for the February harvest are at a continued high level. *Malaya's* rice acreage is expected to be at about the same rate as in the last three years. Most of the crop will be harvested in the first four months of 1956.

Reduced water supplies from mountain sources in *Iran* and *Iraq* resulted in crop decreases of 39 and 30% respectively below last year's large crops. As a result, exportable supplies from *Iran* will decline sharply from recent years and exports from *Iraq* are now prohibited.

Rice acreage in *Europe* was maintained at the high level reached in postwar years. Good crops were harvested in *Italy*, *Spain*, *Portugal* and *France*. Floods in *Greece* late in the season damaged some of the rice crop, so that yields per acre were reduced somewhat.

*Egypt* harvested another large crop in 1955 and therefore is expected to have more rice than in 1954 for export. An estimate of *Australia's* 1955–56 rice acreage being planted is not yet available; the yields per acre harvested in the April–May 1954–55 crop were unusually high and a large upward crop revision was reported.

The 1955 rice crop of *North America* declined for the first time in five years. This is due mainly to a reduction in the acreage of the *U.S.A.;* the trend is noticeable also in *Cuba* and the *Dominican Republic*. A record acreage is reported in *Mexico* and so far crop conditions are reported about average for the harvest from August through January.

Much of *South America's* rice crop was planted late in 1955 and will not be harvested until well into 1956. Under average weather conditions, the harvests of *Brazil* and *Peru* will exceed the crops of last year. *Venezuela's* acreage is down and yields per acre are substantially less than the exceptional yields of 1954.

*For. Crops & Markets.*

### ENGLAND AND WALES

**Agricultural report.** Agricultural conditions in England and Wales on 1 December, 1955, have been summarised by the Ministry of Agriculture, Fisheries and Food.

Conditions were generally favourable for cultivations and sowing, and work is well forward. Autumn-sown crops are generally strong and healthy. The lifting of potatoes is almost complete; quality and condition are generally good. Good progress was made with the lifting of sugar-beet and mangolds. Livestock have done well.

**Weather conditions**

The weather during the first fortnight of November was mild and rather changeable with heavy rain in some areas, but more settled and mostly dry conditions followed and continued for the remainder of the month. Occasional ground frosts occurred.

**Autumn cultivations**

Good progress was made with autumn cultivations in all areas and, in general, field work is well forward. Conditions were favourable for sowing corn and on the whole seedbeds were satisfactory, although reports from a few districts indicate that they were rather rough and dry.

**Autumn-sown crops**

*Wheat* has germinated well and is healthy and vigorous.

*Barley* has germinated well and is making good progress.

*Oats* are a regular plant of good colour and vigorous growth.

*Rye* is strong and healthy.

*Beans* germinated well and have made good growth.

**Sugar-beet**

Good progress was made with the harvesting of sugar-beet. Roots are of good quality and in the main sugar content is satisfactory. The dirt tare is low.

**Winter keep**

In many areas the open weather during the month has enabled livestock to continue grazing, but in some districts pastures have not recovered from the dry summer and have provided less keep than usual. Good use has been made of root tops, but on the whole stocks of winter keep have not been drawn on to any great extent. Given normal weather conditions, supplies of winter keep should be adequate.